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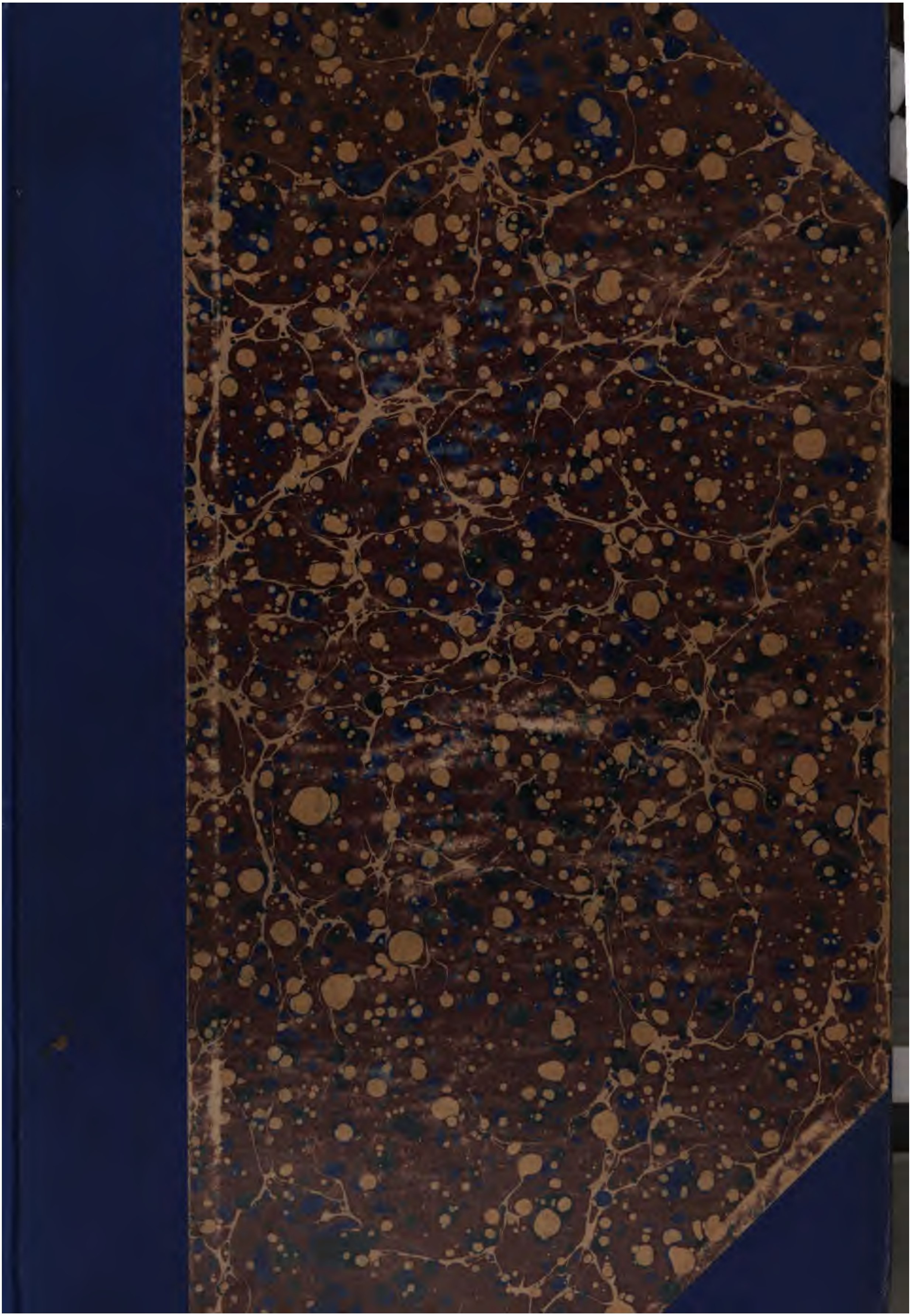

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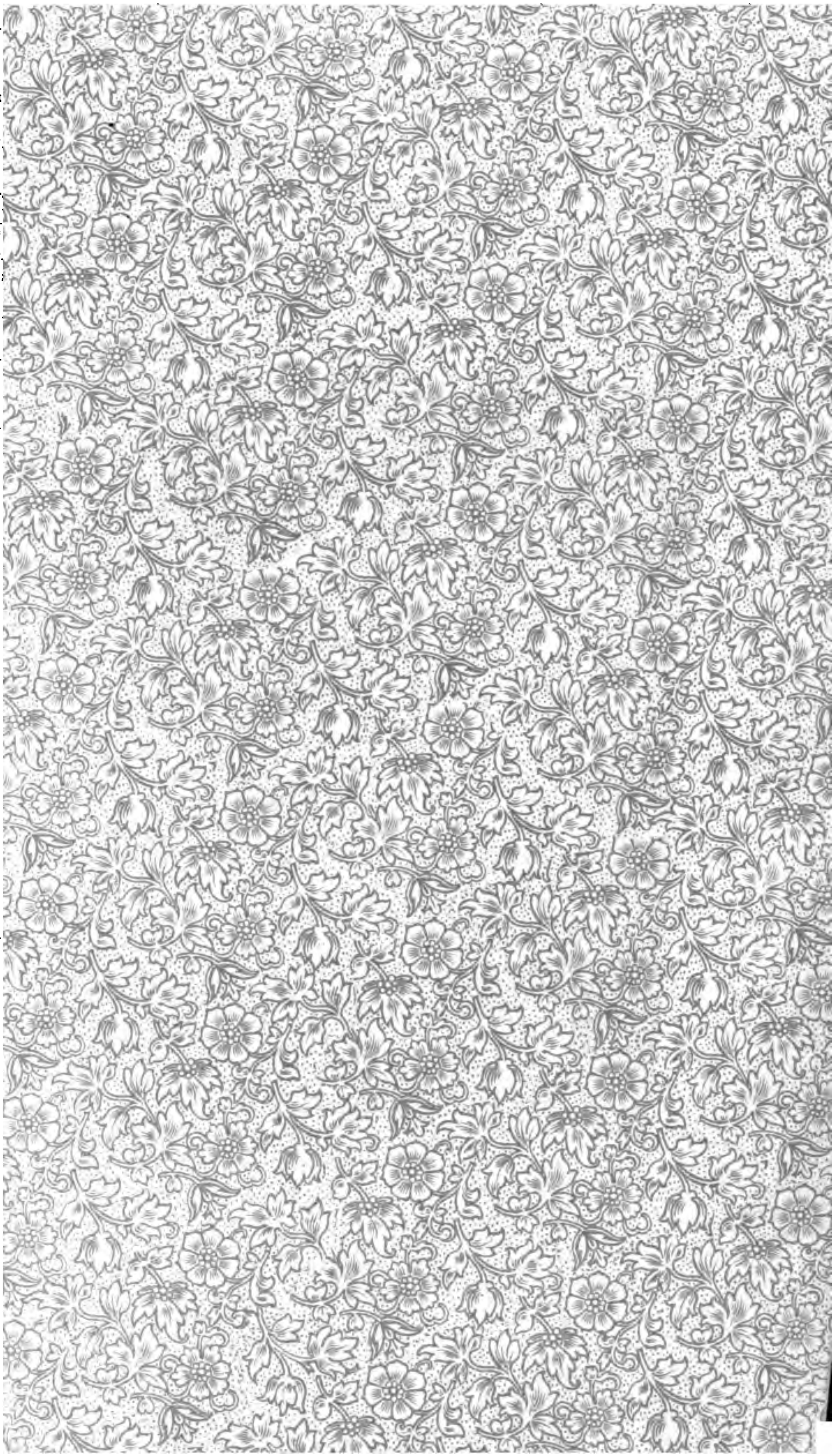

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VOL. VI. No. 7.

THE PHYSICAL BASIS OF PRECOCITY AND DULLNESS.

W. TOWNSEND PORTER.

Issued March 21, 1893.

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THE PHYSICAL BASIS OF PRECOCITY AND DULLNESS.*

W. TOWNSEND PORTER.

(From the Laboratory of Physiology in the St. Louis Medical College.)

In December, 1891, I received the permission of the St. Louis Board of Public Schools to collect physical measurements of the school children.

The investigation began on January 4, 1892, and was finished the fourth week in March, having extended over eleven of the fourteen weeks of winter. The weight, height, length and breadth of head, vital capacity of chest, acuteness of vision, nationality of parents, and many other facts were secured from thirty-three thousand five hundred boys and girls. The larger part of the measurements were made by the teachers, whose hearty co-operation and efficient service in this work should earn them the gratitude of every friend of science.

The great store of facts thus obtained has been used to determine the laws of normal growth of the children of St. Louis in the hope that on this firm ground may be established a system of grading which shall take into account the physical capacity of the pupil in the apportionment of school tasks. An adaptation of mental work to strength is no new idea. Many a sporadic attempt has been made to modify the standard requirements established for the average boy or girl in favor of the exceptionally weak or strong. Such efforts have rested in the past on pure empiricism. Only when the laws of growth are accurately known, is it possible to know with certainty how much the growth of an individual exceeds or falls below the normal mean, and without this knowledge the regulation of mental labor from a physical standpoint is a venturesome groping rather than a scientific deduction.

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* Read before The Academy of Science of St. Louis, March 6, 1893.

The rational basis for this far-reaching reform in school hygiene is fast being laid. Foreign governments are making extended anthropometric measurements of children of all ages, and in our own land private enterprise and zeal for the advancement of learning have borne the burden of investigations that should be matters of public concern. Indeed, it is an American physiologist, Henry P. Bowditch, to whom must be given the honor of having first measured weights and heights of boys and girls in numbers sufficiently large to fix with certainty the general laws of growth.

It is evident that a due regard must be paid to exceptions in the application to special classes of laws true only of the mean of all classes at each age in the period of development. The dull and the precocious constitute such special classes. It is therefore of the highest interest and importance to determine whether dullness and precocity are associated with a physical variation from the mean so palpable that it can be recognised by the coarse methods of investigation practicable in school work.

Of these methods, none is more useful than weighing, partly because it is easy to weigh and partly because the weight has a very close relation to strength. The weight in fact may be looked upon as an index of physical development. By weighing then may be answered the questions: Are dull children in the mean weaker and precocious children in the mean stronger than the average child? Is there a physical basis for precocity and dullness? Is mediocrity of mind associated in the mean with mediocrity of physique? All these questions must be answered in the affirmative, and I will now ask you to examine the method by which this answer has been reached.

The course of study in the Public Schools of St. Louis is divided into eight grades, of which the first is the lowest. To these must be added the kindergartens and the High School, including the relatively small Normal School for the training of women to be teachers. Children are admitted to the kindergartens at six years. Some pupils will be found in the High School at age twenty-two. In the higher grades, however, the number of girls over seventeen and of boys over sixteen years of age is too small to serve as material for our present needs. My conclusions are therefore limited to twelve years in the life of girls and eleven years in the life of boys.

TABLE No. 1.

Distribution by School Grades of the weights of boys aged 9.

GRADES. Pounds.	I.	II.	III.	IV.	V.
90	....	1	....	....	....
89	....	....	....	....	....
88	....	1	....	....	....
87	....	....	....	....	....
86	....	....	....	....	....
85	....	....	1	....	....
84	....	....	....	....	....
83	1	....	....	....	....
82	....	2	1	....	....
81	....	....	1	....	....
80	....	....	1	....	....
79	....	....	....	1	....
78	....	4	....	....	....
77	....	1	4	....	....
76	....	5	3	1	....
75	....	1	1	1	....
74	1	5	2	....	1
73	1	7	4	....	....
72	3	5	4	1	....
71	3	6	4	2	...
70	7	16	6	1	....
69	5	10	6	1	....
68	1	17	6	...	....
67	1	21	10	2	....
66	3	29	8	2	....
65	11	22	14	3	1
64	21	53	18	2	....
63	17	44	22	4	....
62	25	63	13	....	....
61	25	54	23	4	....
60	29	72	21	3	....
59	29	61	16	2	....
58	27	74	23	3	....
57	37	65	17	1	....
56	33	62	14	1	....
55	39	91	21	3	1
54	30	72	18	2	....
53	39	78	10	....	....
52	33	52	18	1	....
51	28	50	14	....	....
50	25	48	10	1	....
49	20	28	6	1	....
48	14	24	4	....	....
47	19	14	1	1	....
46	8	8	....	....	....
45	13	11	1	....	....
44	7	7	3	....	....
43	5	3	....	....	....
42	1	2	....	....	....
41	3	2	1	....	....
40	2	....	1	....	....
39	2	....	1	....	....
38	1	1	1	....	....
37	....	....	1	....	....
36	....	....	1	....	....
35	1	....	....	....	....
34	....	1	2	....	....
33	....	1	....	....	....
32	....	1	....	....	....
Total....	570	1195	357	44	3
50 p. c......	285	597.5	178.5	22	....

Within this period, children of the same age are found in several grades. Thus of 1,334 girls aged thirteen whose weight was recorded, 6 were in Grade I, and 6 in the High School, the remainder being distributed through the other grades, the greatest number (363) being in Grade IV. But here the number in the highest and lowest grades is again too small for our present purpose. For this reason, no number less than 20 has served as a basis for the calculations we are presently to consider.

The distribution of the weights of boys aged nine by School Grades is shown in Table No. 1, compiled from the forms filled out in the schools by those who weighed the pupils.

In this table the weight is expressed in pounds in the column on the left, and opposite each pound is placed the number of boys of that weight in each grade.

The mean weight is obtained for each grade by adding the figures in the grade column, beginning at the bottom, until the sum cannot be increased by the next number without exceeding 50 per cent of the total number in the grade. This point is marked in the columns of the above table by an underscore. Somewhere in the first number above this line lies the mean of all the observations in the column. Its position may be determined by interpolation. An example will make this clear. Let us calculate the mean weight of boys of nine years in Grade II.* Fifty per cent of the 1,195 boys in this age and grade is 597.5. Adding up the column we reach 556 at 56 pounds. The next number in the column would make 621, which is more than 50 per cent of 1,195. The mean is therefore greater than 57 pounds and less than 58 pounds. The difference between 597.5 and 556 is 41.5, which is 64 per cent of 65. Thus the mean weight is 57.64 pounds.

The mean weight in pounds for each grade is printed in DOUBLE FACED type in Table No. 2 (boys), and Table No. 3 (girls), along with the number of observations (lower case type) from which each weight was calculated. The mean weight at each age irrespective of grade is also given. In Table No. 4, the weights in the two preceding tables are expressed in kilograms, the figures for boys being in DOUBLE FACED type.

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* This method is that used by Galton. See *Natural Inheritance,* London, 1889, Chapter IV.

TABLE No. 2.

Age at nearest Birthday.	Mean Weights	Weights of St. Louis School Boys distributed by Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six	**43,74** 707	**43,58** 622	**45,29** 76									Pounds.
Seven	**47,78** 1814	**45,55** 534	**48,48** 1205	**52,00** 59								"
Eight	**52,58** 2188	**47.80** 28	**51,79** 1497	**54,48** 622	**57,00** 24							"
Nine	**57,75** 2188		**55,87** 570	**57,64** 1195	**59,66** 357	**61,75** 44						"
Ten	**62,48** 2064		**60,19** 207	**61,14** 789	**64,00** 766	**64,91** 269						"
Eleven	**68,47** 1644		**68,50** 59	**65,45** 311	**68,12** 664	**69,24** 546	**71,29** 123	**73,84** 33				"
Twelve	**73,61** 1242		**70,00** 28	**69,50** 104	**72,17** 430	**73,86** 602	**74,69** 306	**77,29** 141	**76,50** 22			"
Thirteen	**79,85** 946			**74,25** 38	**75,95** 149	**78,48** 352	**80,90** 336	**82,17** 229	**88,50** 78	**82,00** 34		"
Fourteen	**88,08** 498				**81,00** 46	**84,00** 184	**87,88** 194	**87,20** 242	**98,68** 143	**97,50** 88	**86,50** 25	"
Fifteen	**100,20** 203					**89,00** 26	**95,88** 58	**99,17** 125	**105,50** 103	**105,17** 98	**105.08** 51	"
Sixteen	**114,17** 71							**114,50** 25	**104,00** 28	**114,00** 60	**128,00** 66	"

TABLE No. 3.

Age at nearest Birthday.	Mean Weights	Weights of St. Louis School Girls distributed by Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six.	41,84 798	41,65 711	45,08 71									Pounds.
Seven	45,84 1714	43,87 599	46,76 1031	49,88 67								"
Eight..............	50,85 2147	46,50 35	49,60 1408	52,10 643	58,17 45							"
Nine	55,17 2055		52,57 445	55,44 1175	57,18 365	60,00 48						"
Ten.........	60,46 1947		57,00 128	59,59 739	61,15 798	61,64 235						"
Eleven	65,64 1708		66,34 40	62,95 293	65,50 654	66,77 551	68,12 133					"
Twelve............	73,23 1676		71,75 21	69,80 116	71,50 351	72,74 657	75,18 347	75,92 139	78,50 27			"
Thirteen............	83,78 1348			79,50 41	76,50 129	81,92 363	82,78 328	86,95 301	87,63 121	88,50 87		"
urteen	93,94 1082				90,50 55	87,17 147	92,67 230	94,64 289	96,15 190	99,00 100	103,12 39	"
teen.............	103,20 690					98,50 37	100,96 69	99,83 161	104,00 146	104,58 153	105,15 109	"
ixteen.............	110,06 420							108,12 45	107,88 59	110,29 104	118,57 188	"
enteen	115,69 230									111,00 24	116,00 182	"

TABLE No. 4.

Age at nearest Birthday.	Mean Weights	Weights of St. Louis **BOYS** and Girls distributed by Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six..................	**19,85** 18,99	**19,78** 18,90	**20,56** 20,46									Kilograms.
Seven	**21,66** 20,81	**20,68** 19,92	**22,02** 21,23	**23,61** 22,64								"
Eight................	**23,87** 22,85	**21,70** 21,11	**23,52** 22,51	**24,70** 23,65	**25,88** 24,13							"
Nine	**26,22** 25,04		**25,38** 23,86	**26,20** 25,17	**27,10** 25,96	**28,03** 27,24						"
Ten	**28,36** 27,45		**27,33** 25,88	**27,74** 27,05	**29,06** 27,76	**29,46** 27,98						"
Eleven	**31,08** 29,80		**28,83** 30,12	**29,74** 28,58	**30,92** 29,74	**31,43** 30,31	**32,41** 30,93	**33,29**				"
Twelve	**33,41** 33,25		**31,78** 32,57	**31,55** 31,69	**32,78** 32,46	**33,53** 33,02	**33,91** 34,11	**35,05** 34,47	**34,73** 35,64			"
Thirteen.............	**36,25** 38,00			**33,73** 36,09	**34,50** 34,73	**35,61** 37,19	**36,73** 37,58	**37,27** 39,47	**37,91** 39,78	**37,23** 40,18		"
Fourteen	**39,98** 42,65				**36,77** 41,09	**38,14** 39,57	**39,87** 42,07	**39,59** 42,97	**42,51** 43,65	**44,27** 44,95	**39,27** 46,82	"
Fifteen.	**46,85** 46,85					**40,41** 44,72	**43,28** 45,83	**45,02** 45,32	**47,89** 47,22	**47,74** 47,48	**47,71** 47,74	"
Sixteen..............	**51,83** 49,96							**51,98** 49,09	**47,22** 48,75	**51,76** 49,69	**55,84** 51,56	"
Seventeen	52,52									50,39	52,66	"

When these tables are examined it is seen that in each age the mean weight of pupils in the higher grades is greater than the mean weight of all pupils at that age and exceeds still more the mean weight of pupils in the lower grades.* This fact is more conspicuous when the grade weights in Tables No. 2 and No. 3 are expressed graphically. The curves thus secured are reproduced in Plate I. The mean weight of all pupils at each age is marked on the curve by a small perpendicular line near the figure indicating the age. The abnormal deviation of the ends of some of the curves from the general slope of the curve is due to the number of observations at these points being too small for trustworthy results.

The truth which the curves in Plate I express is very plain. They declare in unmistakable lines that precocious children are heavier and dull children lighter than the mean child of the same age. They establish a physical basis of precocity and dullness.

Whether means or averages are the more trustworthy tools in investigations of this sort is a matter of opinion. So long as their respective value is a subject of controversy investigators will accept no results as final which can be supported only by means. It must therefore be my first concern to show that the law: MEAN PRECOCITY IS RELATED TO MEAN PHYSICAL DEVELOPMENT may with equal truth be written: AVERAGE PRECOCITY IS RELATED TO AVERAGE PHYSICAL DEVELOPMENT.

In Table No. 5 are found the average weights of boys distributed by school grades, and the average weights irrespective of grade. Pounds are in **DOUBLE-FACED** type and kilograms in "lower case" type. The number of observations is in each case the same as in Table No. 2.

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* The end weights of the series at same age are calculated from so small a number of observations that they sometimes vary from the law which the more numerous observations toward the middle of the series show to be true.

PLATE I.

MEAN WEIGHTS OF ST. LOUIS SCHOOL CHILDREN, DISTRIBUTED BY GRADES.

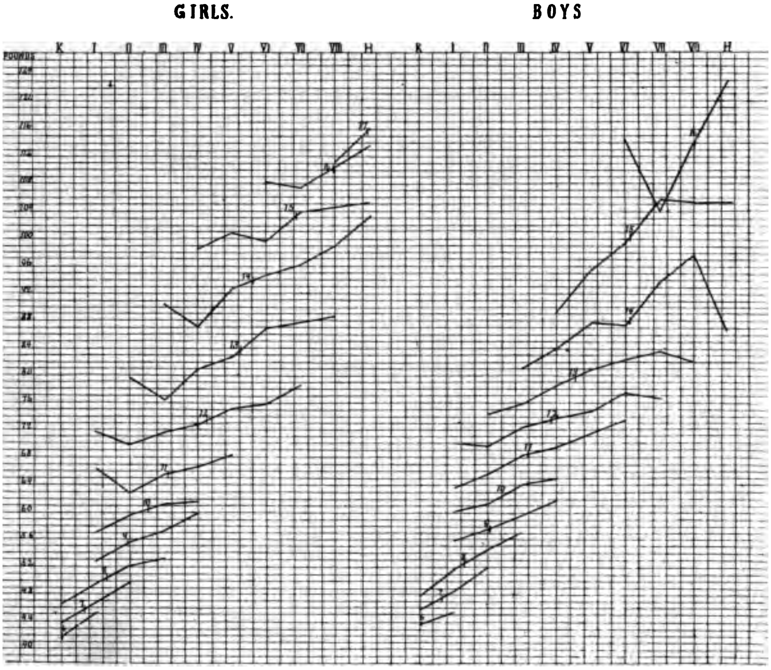

TABLE No. 5.

Age at nearest Birthday.	Average Weights	Average Weights of St. Louis School Boys distributed by Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six	43,49 19,75	43,27 19,64	44,99 20,42									Pounds Kilogr.
Seven	47,78 21,67	45,26 20,79	48,49 22,01	52,75 23,95								Pounds Kilogr.
Eight	52,39 23,78	48,21 21,89	51,58 23,42	54,32 24,66	57,38 26,02							Pounds Kilogr.
Nine	57,41 26,06		55,52 25,22	57,56 26,18	59,26 26,90	61,91 28,11						Pounds Kilogr.
Ten	62,38 28,32		60,36 27,41	61,10 27,74	63,57 28,86	64,38 29,20						Pounds Kilogr.
Eleven	68,30 31,00		64,22 29,16	65,55 29,76	67,77 30,77	71,39 32,41	72,37 32,85	74,12 33,65				Pounds Kilogr.
Twelve	73,82 33,51			70,68 32,06	71,86 32,63	74,31 33,73	75,26 34,17	77,88 35,33				Pounds Kilogr.
Thirteen	80,65 36,61			74,00 33,60	77,00 34,96	78,88 35,79	81,94 37,20	83,69 38,00	86,88 39,42	82,26 37,33		Pounds Kilogr.
Fourteen	89,09 40,44				84,68 38,42	85,59 38,86	90,68 41,17	87,75 39,87	93,28 42,35	98,22 44,59	91,88 41,72	Pounds Kilogr.
Fifteen	101,80 46,22					92,52 42,00	98,71 44,81	99,38 45,12	106,16 48,20	104,72 47,54	103,27 46,88	Pounds Kilogr.
Sixteen	113,65 51,60							116,60 52,93	102,00 46,31	114,57 52,01	123,77 56,19	Pounds Kilogr.

TABLE No. 5.

Age at nearest Birthday.	Average Weights	Average Weights of St. Louis School **Boys** distributed by Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six.................	**43,49** 19,75	**43,27** 19.64	**44,99** 20,42									**Pounds** Kilogr.
Seven..............	**47,73** 21,67	**45,26** 20,79	**48,49** 22,01	**52,75** 23,95								**Pounds** Kilogr.
Eight...............	**52,39** 23,78	**48,21** 21,89	**51,58** 23,42	**54,32** 24,66	**57,33** 26,02							**Pounds** Kilogr.
Nine...............	**57,41** 26,06		**55,52** 25,22	**57,56** 26,13	**59,26** 26,90	**61,91** 28,11						**Pounds** Kilogr.
Ten.................	**62,38** 28,32		**60,36** 27,41	**61,10** 27,74	**63,57** 28,86	**64,38** 29,20						**Pounds** Kilogr.
Eleven.............	**68,30** 31,00		**64,22** 29,16	**65,55** 29,76	**67,77** 30,77	**71,39** 32,41	**72,37** 32,85	**74,12** 33,65				**Pounds** Kilogr.
Twelve.............	**73,82** 33,51			**70,63** 32,06	**71,86** 32,63	**74,31** 33,73	**75,26** 34,17	**77,83** 35,33				**Pounds** Kilogr.
Thirteen............	**80,65** 36,61			**74,00** 33,60	**77,00** 34,96	**78,83** 35,79	**81,94** 37,20	**83,69** 38,00	**86,83** 39,42	**82,26** 37,33		**Pounds** Kilogr.
Fourteen...........	**89,09** 40,44				**84,63** 38,42	**85,59** 38,86	**90,68** 41,17	**87,75** 39,87	**93,28** 42,35	**98,22** 44,59	**91,88** 41,72	**Pounds** Kilogr.
Fifteen.......... ..	**101,80** 46,22					**92,52** 42,00	**98,71** 44,81	**99,38** 45,12	**106,16** 48,20	**104,72** 47,54	**103,27** 46,88	**Pounds** Kilogr.
Sixteen.............	**113,65** 51,60							**116,60** 52,93	**102,00** 46,31	**114,57** 52,01	**123,77** 56,19	**Pounds** Kilogr.

This table shows that the statements in the preceding pages are supported by averages as well as means, and on this double foundation the law of the relation between precocity and physical development may well rest secure.

It is not enough to know that the mean and the average child follow this law. We must also know whether small precocious children are heavier than small dull children and on the other hand, whether large precocious children are heavier than large dull children.

To determine this we will have recourse to Galton's schemes of distribution.* If a thousand children at the same age were placed in line according to stature, the height of the middle or 500th child would be the mean (Galton's nomenclature) of the heights of the entire number. The larger children would be at one end of the line and the smaller children at the other. If we took the 300th child, counting from the middle of the line in both directions, we should have one large and one small child at an equal distance from the mean, and the weights of these children might be safely compared with the weights of children similarly selected from a series of 1,000 at another age.

A process analogous to this has been followed with the children's weights in the present instance. I have taken at each school grade and age 20 and 80 per cent of the total observations. The figures in the pound column opposite which these percentages fall represent respectively the weights of a small and a large child, and these weights may be compared with those obtained in a similar manner from other school grades and ages. Table No. 6 is made from the 20 "percentile," as Galton would call it, and thus contrasts the weight of small children in different school grades, and Table No. 7 is made from the 80 "percentile," representing the large children. In both tables, boys' weights are printed in **DOUBLE-FACED** type. The mean weights of small children (20 "percentile"), irrespective of school grades, are placed in the column on the left in Table No. 6 and the mean weights of large children (80 "percentile"), irrespective of school grade, occupy a similar position in Table No. 7.

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* Fully explained in Galton's *Natural Inheritance*, London. 1889. Chap. IV.

TABLE No. 6.

Age at nearest Birthday.	Mean Weights	Weights of small Boys and Girls (20 "percentile") by School Grades.										Unit of Measure-ment.
		Kinder-garten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six	**40,33** 38,31	**40,34** 38,22	**39,87** 40,15									Pounds.
Seven	**43,55** 41,58	**41,90** 40,00	**44,45** 42,78	**46,93** 45,23								"
Eight	**47,58** 45.46	**42,80** 41,33	**46,69** 44,87	**49,78** 47,10	**52,80** 48,00							"
Nine...............	**52,33** 49,90		**50,00** 47,64	**52,73** 50,32	**53,64** 51,46	**55,98** 52,60						"
Ten	**56,31** 53,96		**54,46** 51,30	**55,15** 52,97	**58,01** 54,43	**57,91** 57,29						"
Eleven	**61,42** 58,99		**56,60** 55,50	**59,25** 56,97	**61,20** 59,21	**63.28** 59,89	**65,66** 61,27	**65,80**				"
Twelve.............	**66,20** 64,77		**62,60** 59,50	**62,60** 61,70	**64,55** 63,77	**67,37** 64,62	**67,65** 66,78	**69,40** 67,96	**63,20** 69,60			"
Thirteen...........	**70,80** 72,79			**65,60** 71,60	**68,95** 68,64	**70,13** 70,54	**71,27** 72,93	**73,97** 75,73	**74,60** 77,44	**71,70** 77,80		"
Fourteen	**78.65** 80,90				**75,30** 77,50	**75,70** 79,23	**79,70** 81,37	**78,40** 82,18	**81,80** 84,33	**86,30** 87,67	**79,00** 87,40	"
Fifteen	**85,95** 92,09					**81,13** 83,40	**84,60** 89,80	**85,00** 89,14	**91,58** 93,40	**87,87** 95,23	**89,10** 91,40	"
Sixteen............	**98,12** 100,50							**103,00** 94,00	**89,80** 97,40	**98,00** 101,80	**111,20** 103,94	"
Seventeen	**113,10** 105,25									99,80	105,34	"

TABLE No. 7.

Age at nearest Birthday.	Mean Weights	Weights of large Boys and Girls (80 "percentile") by School Grades.										Unit of Measurement.
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	High School.	
Six................	**47,83** 45,92	**47,42** 45,71	**50,90** 49,95									
Seven...............	**52,42** 50,57	**49,46** 48,47	**53,20** 51,64	**59,20** 55,87								
Eight...............	**58,02** 55,71	**54,85** 49,75	**57,04** 54,73	**59,87** 56,92	**65,40** 60,00							
Nine................	**63,86** 61,34		**61,84** 59,00	**63,13** 61,33	**65,40** 63,00	**70,20** 69,70						
Ten................	**69,21** 67,37		**66,27** 63,70	**67,22** 65,69	**70,17** 68,22	**70,94** 69,44						
Eleven..............	**75,67** 73,93		**72,07** 72,50	**73,08** 71,55	**75,07** 73,77	**76,77** 75,48	**77,18** 75,77	**83,40**				
Twelve..............	**81,35** 82,97		**77,40** 77,60	**78,55** 79,80	**79,40** 81,35	**81,00** 82,87	**82,53** 86,65	**85.26** 85,20	**87,20** 87,20			
Thirteen............	**89,90** 96,41			**80,68** 89,40	**83,70** 89,20	**87,28** 93,93	**91,56** 97,16	**93,08** 100,29	**98,85** 102,60	**89,07** 104,60		
Fourteen............	**103,04** 107,08				**94,80** 105,50	**96,05** 104,15	**104,07** 105,70	**102,65** 108,05	**102,76** 106,71	**109,70** 112,50	**107,00** 108,60	
Fifteen.......... ...	**117,48** 113,82					**101,20** 106,60	**110,85** 112,10	**115,50** 110,63	**120,10** 120,11	**121,10** 114,47	**119,90** 116,05	
Sixteen.............	**129,93** 123.00							**126,00** 119,00	**114,20** 115,20	**136,00** 121,40	**137,80** 124,80	
Seventeen..........	**136,93** 126,25									126,20	126,53	

The coincidence of high weights and high school grades so clearly demonstrated by previous tables is seen with equal clearness here. Small dull children are under, small precocious children above the mean weight of small children of their age, and the same is true of large children.

If weight is indeed a good index of physical development, it is *a priori* probable that height, girth of chest and other dimensions follow the law induced above. An analysis of the measurements at any age will show that this assumption is well grounded. Age 10, boys, and age 12, girls, may be selected for this purpose, as the number of observations at these ages is large and the pupils are found in several grades. The analysis of the height standing of boys aged 10 and girls aged 12 is seen in Tables No. 8 and No. 9 respectively.

TABLE NO. 8.

The Mean and the Average Height Standing of Boys, Aged 10.

School Grade.	Mean.	Average.	No. of Observations.
I	126.50 cm.	126.13 cm.	109
II	129.39	128.78	440
III	130.29	129.96	436
IV	131.22	131.99	185
V	.....	......	11
VI	......	......	3

TABLE NO. 9.

The Mean and the Average Height Standing of Girls, Aged 12.

School Grade.	Mean.	Average.	No. of observations.
I	......	......	14
II	136.06 cm.	135.93 cm.	73
III	139.04	138.97	217
IV	140.08	139.77	395
V	141.96	140.57	227
VI	141.90	141.80	110
VII	......	......	14

It appears that precocious children are taller as well as heavier than dull children.

The measurement of the girth of chest in girls is more difficult than in boys, and in both sexes is more subject to error than the measurement of weight or height. For this reason it is advisable, at least in the case of girls, to divide the material into three groups, rather than to treat it by single grades. The result is not materially different in either method, but the means of the three large groups are more deserving of confidence than the means of the more numerous grades.

TABLE NO. 10.

Distribution of Girls, Aged 12. Girth of Chest at Forced Expiration.

School Grade.	No. of Observations.
I	13
II	68
III	204
IV	381
V	210
VI	111
VII	13
VIII	3

Grade IV, containing the greatest number of girls, is the mean grade at this age. With it may be compared the mean girth of chest of the 285 girls in grades I, II and III, and the 337 girls in the higher grades V, VI, VII and VIII. The following results appear:

TABLE NO. 11.

The Girth of Chest at Forced Expiration in Dull, Mediocre and Precocious Girls, Aged 12.

School Grade.	Mean.	No. of Observations.
I, II, III	66.21 cm.	285
IV	66.78	381
V, VI, VII, VIII	67.89	337

TABLE NO. 12.

The Girth of Chest at Forced Expiration in Boys, Aged 10.

School Grade.	Mean.	Average.	No. of Observations.
I	62.96 cm.	62.62 cm.	115
II	63.27	63.11	454
III	63.94	63.81	462
IV	64.24	64.32	189
V	......	......	12
VI	......	......	3

Successful pupils have larger chests than the unsuccessful.

The width of head, or distance from one parietal eminence to the other, measured with callipers, is also greater in more advanced pupils than in those less advanced.

TABLE NO. 13.

The Width of Head of Girls, Aged 12.

School Grade.	Mean.	Average.	No. of Observations.
I	......	......	11
II	144.25 mm.	143.68 mm.	68
III	145.52	144.77	193
IV	145.75	144.94	343
V	146.24	145.50	217
VI	148.08	147.64	89
VII	......	......	10
VIII	......	......	4

TABLE NO. 14.

The Width of Head of Boys, Aged 10.

School Grade.	Mean.	Average.	No. of Observations.
I	146.06 mm.	145.86 mm.	92
II	146.38	146.73	408
III	146.71	146.48	397
IV	147.45	147.21	170
V	......	......	21

NOTE.—The following information may be of interest. The classification of pupils is irrespective of nationality. The children were weighed on Fairbanks Standard Scales in indoor winter clothing. The shoes were taken off when the height standing was measured. The girth of chest was taken over the shirt in boys and over the dress in girls, in each case on a level with the nipples. The occasional corset was removed. Head measurements were made by undergraduates of the St. Louis Medical College.

So far as I am aware, the only other investigations into the relation between physical development and success in school life are recorded in the Inaugural Dissertations of Dr. Gratsianoff and Dr. Sack. Dr. Gratsianoff measured the children in Arzamas, a small town in the province of Nijni Novgorod. He claims, as I learn from the work of Sack, that successful pupils are larger than the unsuccessful and that the rate of growth is quicker in the successful. Sack (*Physical Development of the Children in the Middle Schools of Moscow.* 1892. Russian.) rejects the work of his predecessor, as founded "for the most part on a totally insufficient number of observations" (page 131). Sack's own results are derived from the examination of 4,245 boys, distributed among eight school grades; 2,600 were measured twice. Including the latter, the extent of Sack's material up to age 18 is seen in the following extract from his table on page 57:

Age.	No. Observed.	Age.	No. Observed.
7–8	1	12–13	772
8–9	13	13–14	830
9–10	76	14–15	744
10–11	450	15–16	788
11-12	671	16–17	833

No weights have been published. The author confirms Gratsianoff's

It cannot be by chance that ages ten and twelve have yielded these results, so exactly fulfilling the expectations raised by the analysis of weights. What is true of these ages is undoubtedly true of all ages in the period of development. There is no reason to apprehend that other dimensions, such as height sitting, span of arms, etc., are execptions to the law which has been shown to exist in respect of weight, height standing, girth of chest and width of head.

We have thus far in this paper dealt with the dimensions of children of the same age. The relation between precocity and the rate of growth or yearly increase in size has not been considered, and to this most interesting subject we must now turn.

The material for the comparison of the rate of growth of dull and precocious children is found in the weights of boys and girls distributed by school grades. The manner of treating this material will be best understood by a statement of the method used in getting the weight of the mean dull and the mean precocious child at any age. Girls aged 13 may serve as an example. Their distribution by school grades is as follows:

School Grades.	No. of Observations.
I	6
II	41
III	129
IV	363
V	331
VI	300
VII	121
VIII	37
High School	6
Total	1,334

The mean success in school life of girls at this age is indicated by the mean of these nine grades. Fifty per cent

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statement that the more successful children are taller and have larger chests than the less successful, but finds a uniform rate of growth in these dimensions.

My own results were reached before I knew of the work of the Russian scientists.

of the total number of girls is 667. Adding up the column, 464 is reached at Grade V; to add the girls in this grade would make the sum greater than 50 per cent of 1,334. The mean lies, therefore, in Grade V. The difference between 667 and 464 is 203, which is 61 per cent of 331. That is to say, a line drawn at the mean grade of girls, aged 13, would divide them into two groups, the one consisting of the High School, Grades VII, VI, and 61 per cent of the girls in Grade V, and the other, consisting of 39 per cent of Grade V, and Grades IV, III, II, and I. The total number would thereby be divided into two classes according to success in school life, and success in school life, like success in after life, is on the average a fair test of intelligence.

The actual division of the pupils into these two classes cannot be carried out until the number of observations at each pound in Grade V is multiplied by 0.61 and 0.39, thus making two columns, one of which contains 61 and the other 39 per cent of the observations in the grade. The former is added to the number of observations at each pound in Grades VI, VII, VIII, and the High School, and the latter similarly added to Grades IV, III, II, and I. The mean of the one group is the weight of the mean precocious girl and the mean of the other, the weight of the mean dull girl.

The weights calculated by this method for children of mean dullness and mean precocity are placed in Tables No. 15 and No. 16, in which the mean grade also appears.

TABLE NO. 15.

The Weight of the Boy of Mean Precocity and the Boy of Mean Dullness.

PRECOCITY.			DULLNESS.		
Age.	Grades.	Pounds.	Pounds.	Grades.	Age.
7	.70 I, II, III	48.64	46.69	Kn, .30 I	7
8	.29 I, II, III, IV	53.50	51.59	Kn., .71 I	8
9	.56 II, III, IV, V	58.64	56.12	I, .44 II	9
10	.96 III, IV, V, VI	64.05	60.95	I, II, .04 III	10
11	.25 III, IV, V, VI	69.57	66.96	I, II, .75 III	11
12	.45 IV, V, VI, VII, H. S.	75.24	72.26	I, II, III, .55 IV	12
13	.82 V, VI, VII, VIII	81.00	77.36	1, II, III, IV, .18 V	13
14	.88 VI, VII, VIII, H. S.	90.57	85.69	II, III, IV, V, 12 VI	14
15	.VII VIII, H. S.	105.27	94.78	II, III, IV, V, VI	15
16	.53 VIII, H. S	120.96	105.00	II, III, IV, V, VI, VII, .47 VIII	16

TABLE NO. 16.

The Weight of the Girl of Mean Precocity and the Girl of Mean Dullness.

PRECOCITY.			DULLNESS.		
Age.	Grades.	Pounds.	Pounds.	Grades.	Age.
7	.76 I, II, III	46.96	44.68	Kn., .24 I	7
8	.27 I, II, III, IV	51.20	49.52	Kn., .73 I	8
9	.51 II, III, IV	56.25	54.32	I, .49 II	9
10	.88 III, IV, V, VI	61.34	59.44	I, II, .12 III	10
11	.22 III, IV, V, VI, VII,	66.73	64.84	I, II, .78 III	11
12	.48 IV, V, VI, VII, VIII	74.59	71.72	I, II, III, .52 IV	12
13	.61 V, VI, VII, VIII, H.S	86.43	80.39	I, II, III, IV, .39 V	13
14	.69 VI, VII, VIII, H.S	96.61	92.00	II, III, IV, 31 VI	14
15	.55 VII, VIII, H.S	104.54	100.03	II, III, IV, V, VI, .45 VII	15
16	.20 VIII, H. S	113.31	108.39	IV, V, VI, VII, .80 VIII	16

The meaning of these tables is shown graphically in Plate II. Here are seen three pairs of curves. The uppermost are the curves of increase in weight of boys and girls of mean precocity; the lowermost, the curves of increase in weight of boys and girls of mean dullness. The middle curves give the mean weights irrespective of grade. In each pair the curve of girls' weights is a broken line.

Tables No. 2 and No. 3 support the view that mean weight irrespective of grade, or, in other words, mean weight irrespective of success in school life, is also the mean weight of children of mediocre ability. If this view be correct, the curves of mean weight irrespective of grade may rightfully be compared with curves of weight of precocious and dull children, as has been done in Plate II. The fact that these curves of means irrespective of grade fall almost exactly between the curves of precocity and dullness justifies this comparison.

Again, the mean weight at each age, on the basis of intelligence, *i. e.*, the weight of the mediocre child, should be the same as the mean weight at each age irrespective of intelligence. The two preceding tables, No. 15 and No. 16, contain the mean weight of precocious and dull children. By adding these together at each age and dividing by 2, the weight of the mediocre child is secured. In Tables No. 17 and No. 18, these weights of mediocre children are compared with the mean weights of the whole mass of observations at each age, irrespective of school grade.

TABLE NO. 17.

The Mean of the Weights of Boys of Mean Precocity and Dullness compared with the Mean Weight irrespective of School Grade.

Age.	Mean Precocity.	Mean Dullness.	Mean.	Mean irrespective of School Grades.
7	48.64 lbs.	46.69 lbs.	47.66 lbs.	47.73 lbs.
8	53.50	51.59	52.54	52.58
9	58.64	56.12	57.38	57.75
10	64.05	60.95	62.50	62.48
11	69.57	66.96	68.26	68.47
12	75.24	72.26	73.75	73.61
13	81.00	77.36	79.18	79.85
14	90.57	85.69	88.13	88.08
15	105.27	94.78	100.02	100.20
16	120.96	105.00	112.98	114.17

TABLE NO. 18.

The Mean of the Weights of Girls of Mean Precrocity and Dullness compared with the Mean Weight irrespective of School Grade.

Age.	Mean Precocity.	Mean Dullness.	Mean.	Mean irrespective of School Grades.
7	46.96 lbs.	44.68 lbs.	45.82 lbs.	45.84 lbs.
8	51.20	49.52	50.36	50.35
9	56.25	54.32	55.28	55.17
10	61.34	59.44	60.39	60.46
11	66.73	64.84	65.78	65.64
12	74.59	71.72	73.15	73.23
13	86.43	80.39	83.41	83.73
14	96.61	92.00	94.30	93.94
15	104.54	100.03	102.28	103.20
16	113.31	108.39	110.85	110.06

The coincidence in the two series is noticeable.

The three pairs of curves in Plate II may now be examined in detail. The three full lines of boys' weights run courses not strictly parallel. A slight divergence of the curves of the dull and the precocious is evident in the case of the older boys. This would seem to indicate that the difference in weight between dull and precocious boys increases as they grow older. It would further seem to show that this increasing divergence is associated chiefly with the acceleration of growth at the beginning of puberty, and that precocious boys grow faster than dull boys.

These conclusions may perhaps have an element of truth, but the curves now under examination by no means prove their truth. For it must be noticed that the divergence in question is scarcely perceptible until ages 14 and 15 are reached, ages in which the number of observations is so small as to considerably increase the chance of error. No such divergence is seen in the case of girls' weights, in which the number of observations in the ages 14, 15, and 16 is very much larger. * Bearing this fact in mind, it may be affirmed that *the comparative rate of growth of dull, mediocre and precocious children of the same sex is the same at all ages from 7 to 16 inclusive.* The data at hand are not sufficient to decide whether this law is true of other ages in the period of growth.

Each boys' curve in Plate II is characterized by a gradual and very nearly uniform ascent until age 13 is reached. . Here an acceleration begins, indicated by a more rapid rise of the curves, and this acceleration becomes still more rapid at age 14. It is the expression of the change which precedes puberty. A similar acceleration is seen in girls, but it takes place at an earlier age, the curves beginning their steeper rise at age 11. The curves in Plate II are plotted one directly above the other. The ordinates for the same age are made to coincide in all six curves. It can therefore be readily seen whether the period of acceleration begins earlier or later in dull than in precocious children. This seems not to be the case. *The acceleration in weight preceding puberty takes place at the same age in dull, mediocre and precocious children.*

The growth of boys and girls runs a parallel course in early childhood. At age 6, boys are heavier than girls, and this advantage is maintained for several years. But when the difference of sex begins to make itself felt, the relation between the weights of the sexes is changed, the boys lose their superiority and the curve of girls' weight rises above theirs.

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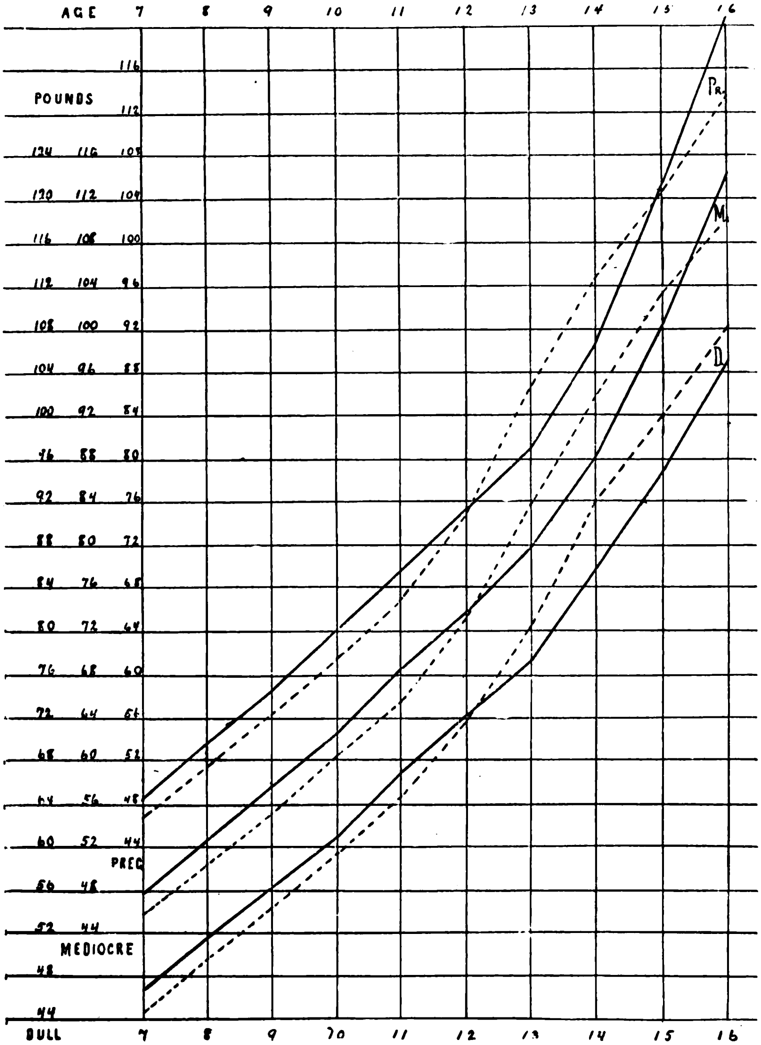
* The extent of this difference in number of observations is seen by comparing the columns on the left of Tables No. 2 and No. 3.

PLATE II.

THE RATE OF GROWTH IN WEIGHT OF DULL, MEDIOCRE AND PRECOCIOUS BOYS AND GIRLS.



FULL LINES REPRESENT BOYS' WEIGHT.
DASHED LINES REPRESENT GIRLS' WEIGHT.

This difference persists for about three years, and then the curves once more cross and the youth is once more heavier than the maid. In Plate II, the curves of girls' weights cross the boys' curves at the same age in dull, mediocre andprecocious children. *The point in the period of accelerated development at which girls become heavier than boys is the same in the dull, the mediocre and the precocious.*

The conclusions reached in this investigation are based on means and averages. How far they are applicable to individuals cannot be determined from the present data. For this, another method must be used. The same children must be weighed from year to year. The variation of the individual from the normal mean or average will then be known. But even without this information, a deduction of great practical importance can be made from the laws established by the present research. *No child whose weight is below the average of its age should be permitted to enter a school grade beyond the average of its age, except after such a physical examination as shall make it probable that the child's strength shall be equal to the strain.*

Issued March 21, 1893.

THE RELATION BETWEEN THE GROWTH OF CHILDREN AND THEIR DEVIATION FROM THE PHYSICAL TYPE OF THEIR SEX AND AGE.

WM. TOWNSEND PORTER.

Quetelet induced from his measurements of children the law that the weights, heights or other physical dimensions at each age in the period of growth are approximations of a median value,[1] about which they are grouped in the form of a probability curve, being related to the median value as the individual observations in a series of measurements of the same thing are related to its actual size. Quetelet assumed that the median value of an anthropometric series expressed the physiological type of the series and that each deviation from this value expressed the physiological difference between an individual and the type. Fifty years of research have placed the truth of Quetelet's law beyond all doubt and have not weakened the reasonableness of his assumption, so that both law and hypothesis are rarely questioned and are regarded as a secure base from which to explore the phenomena of growth.

The degree of deviation of the individual measurements from the median value of an anthropometric series is measured by the Probable Deviation, that value which, in the words of Lexis,[2] is as often exceeded as attained. Hence, if Quetelet's theory is true, the Probable Deviation is a measure of the degree of deviation of individuals from their Physical Type. The Probable Deviation from the median value of a series containing many measurements may be calculated by the approximation formula

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[1] *Moyenne* of Quetelet, see *Lettres sur la Théorie des Probabilités*, Bruxelles, 1846, page 66; and *mean* of Sir John Herschel and other English writers, see *Edinburg Review*, 1850, page 23.

[2] Ueber die Theorie der Stabilität statistischer Reihen. Hildebrand's Jahrbücher für Nationalökonomie und Statistik. Bd. 32, 1879, S. 60–98. See page 62.

$$d = \pm 0.8453 \frac{\Sigma\delta}{n} \qquad (1)$$

where d = Probable Deviation,
δ = Deviation of individual from median value,
$\Sigma\delta$ = Sum of individual deviations,
n = Total number of observations.

The Probable Deviation contains the Error of Observation, as well as the Physiological Difference of the Individual from the Type. The Error of Observation, in a large series of measurements, is always relatively small. Its insignificance can be made clear in several ways. If the height of one boy at any age is measured 1000 times, the Probable Deviation will be much smaller than when the heights of 1000 boys at that age are measured once. Compare, for example, the Probable Deviation from the average height of one boy aged 17 measured 78 times with that of 78 boys aged 17 measured once, the measurements being made under conditions as nearly alike as possible in both instances.

	One Boy aged 17 Measured 78 times.	78 Boys aged 17 Measured once.
Average Height	176.28 cm.	165.13 cm.
Probable Deviation	± 0.24 cm.	± 5.15 "

In the single boy, the Difference of the Individual from the Type is not present and the Probable Deviation is very small: in the 78 boys, the opposite is true. Yet the difficulty of correct measurement and hence the Error of Observation in each measurement in the two series cannot differ greatly. It follows that by far the greater portion of Probable Deviation is made up of the Physiological Difference of Individual from Type.

Again, the Error of Observation is inversely as the square root of the number of observations and should, were it an important constituent of the Probable Deviation, cause the latter to increase as the number of observations decreased.

Thus, in the following table, comparing the Relative Probable Deviation from the average height standing of boys with the square roots of the number of observations, the Probable Deviation should be much greater at ages 17 and 18, in which the number of observations is small, than at age 10 or 11, in in which the observations are much more numerous. A look at the figures shows that the Probable Deviation is very little influenced by variations in the number of observations, within the limits given here. The Probable Deviation may, therefore, without any error of importance, be considered as the Physiological Difference between the Individual and the Type.

Age at nearest Birthday.	Number of Observations.	Square Root.	Relation of Probable Deviation to Average.
6	709	26.63	3.1 %
7	1850	43.01	3.2
8	2223	47.15	3.3
9	2205	46.95	3.0
10	2087	45.68	3.1
11	1819	42.63	3.2
12	1653	40.67	3.2
13	1268	35.62	3.5
14	925	30.42	3.8
15	490	22.14	4.1
16	189	13.75	3.7
17	78	8.85	3.1
18	29	5.40	2.8

Not all observers have taken the Median Value as the Type. The arithmetic mean is frequently employed in Germany, Denmark and elsewhere. In a large series the difference between the two is so small that either may be safely used. The maximum and the mean Median minus Average values for the physical dimensions studied in this paper are as follows:—

MEDIAN MINUS AVERAGE VALUE.

DIMENSION.	UNIT OF MEASUREMENT.	MAXIMUM.		ARITHMETIC MEAN.	
		BOYS.	GIRLS.	BOYS.	GIRLS.
Weight............	Kilogram.........	0.73	0.74	0.23	0.25
Height Standing...	Centimetre	1.00	1.10	0.50	0.49
Height Sitting.....	Centimetre	0.94	0.99	0.44	0.67
Span of Arms......	Centimetre	1.35	1.33	0.53	0.59
Girth of Chest.....	Centimetre	0.84	0.71	0.44	0.46

There can, therefore, be no objection to the use of the

Average in place of Median Value in the series about to be studied.

The accuracy of the average can be estimated by the formula:[1]

$$E = \pm \frac{d}{\sqrt{n}} \qquad (2)$$

where E = Probable Error of Average,
d = Probable Deviation from Average,
n = Number of Observations.

The values for E are given in Tables No. 6, 7 and 8.

It has already been said that the Physiological Difference between the Individual and the Type is expressed by the Probable Deviation from the Average. According to Geissler and Uhlitzsch,[2] the interval between Average minus d and Average plus d increases with the age. The values of d found by them in their measurements of height standing are as follows (page 33):

AGE.	PROBABLE DEVIATION ($A \pm d$). *Boys.* ±	*Girls.* ±
6½ to 7 years	3.4488	3.5926
7 " 8 "	3.5841	3.7362
8 " 9 "	3.8546	3.8293
9 " 10 "	4.0067	3.7785
10 " 11 "	4.2181	4.2265
11 " 12 "	4.2434	4.4125
12 " 13 "	4.5984	4.8013
13 " 14 "	4.7844	5.2155
Over 14 "	5.1479	4.8520

The authors say concerning this table (page 34): —

"Hieraus geht hervor, dass diese Intervalle mit dem Alter "im Allgemeinen zunehmen und es dürfte dies auch ganz "natürlich erscheinen, da wohl anzunehmen ist, dass die das "Wachsthum hemmenden bez. fördernden Ursachen bei den "meisten Individuen ziemlich dieselben bleiben, den Unter-

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[1] Formulas (1) and (2) are contained in L. Stieda's paper: Ueber die Anwendung der Wahrscheinlichkeitsrechnung in der anthropologischen Statistik. *Archiv für Anthropologie*, Bd. xiv, 1882, S. 167–182.

[2] Arthur Geissler and Richard Uhlitzsch. Die Grössenverhältnisse der Schulkinder im Schulinspectionsbezirk Freiberg. *Zeitschrift des königlichen Sächsischen Statistischen Bureaus*, xxxiv, Heft 1 and 2, 1888, S. 28–40.

" schied also in der Grösse der Individuen immer merklicher
" hervortreten lassen. Auch hinsichtlich der Geschlechter ist
" ein Unterschied deutlich bemerkbar und zwar zeigen sich
" für die Mädchen vom 11 Jahre an grössere Schwankungen
" als für die Knaben. Da aber beobachtet worden ist, dass
" die Mädchen circa zwei Jahre vor Eintritt der Pubertäts-
" periode verhältnissmässig rascher wachsen, so dürfte die
" Verschiedenheit, mit welcher der Eintritt dieser Zeit erfolgt,
" wohl ein Grund mit sein für die grösseren Schwankungen."

It appears from this extract from the valuable work of Geissler and Uhlitzsch that they were very near discovering the law which it is the purpose of this paper to demonstrate and would certainly have done so had they not contented themselves with the Absolute Probable Deviation, in which the real Physiological Difference of Individual from Type lies hidden, and had the material furnished them been sufficiently extensive. The Absolute Probable Deviation is entangled with the size of the individual, and its true value can be known only when this disturbing factor is removed. It is the relation between Probable Deviation and size of individual that must be studied, if the character of the Probable Deviation would be known. But even if Geissler and Uhlitzsch had pursued the method just suggested, the limitations of their material would have prevented them from solving the problem completely. For the material given them to analyze extended no further than the fourteenth year, with some observations over, almost wholly missing the period of pre-pubertal acceleration in boys and the early pubertal years in girls and entirely omitting the early pubertal years in boys.

It would seem from their results that the Probable Deviation increases with the age, whereas it shall be presently shown that the Absolute Probable Deviation in height standing as well as in weight, height sitting, span of arms and girth of chest does not increase with age during the whole period of growth. Moreover, the Relative Probable Deviation does not increase during seven of the nine years of boys' growth and five of the nine of girls' growth included in the observations of Geissler and Uhlitzsch, and shows a merely secondary relation to age during the remaining years. They state further that the amount of the Probable Deviation from age 11 on is greater in girls than in boys, meaning of course that this is true within the limits of their own observations. A wider experience shows that the Absolute Probable Deviation in height standing of girls ceases to be greater than that of boys at age 14 (nearest birthday). Finally, it does not appear from the context that the statement " Da aber beobachtet worden ist, " dass die Mädchen circa zwei Jahren vor Eintritt der Pubertätsperiode verhältnissmässig rascher wachsen, so dürfte die " Verschiedenheit, mit welcher der Eintritt dieser Zeit erfolgt, " wohl ein Grund mit sein für die grösseren Schwankungen " includes the conception of the relation of the Probable Deviation to the quickness of growth (to be demonstrated below), as distinct from the absolute difference in size of boys and girls at this period.

Before applying to the present material the ideas which the foregoing paragraphs have attempted to state with some precision, it will be interesting to compare the Probable Deviation of Height Standing of German children in the Freiberg district with that of the St. Louis children.

TABLE No. 1.

A Comparison of the Absolute Probable Deviation from the Average Height Standing of School Children in the Freiberg School District (Geissler & Uhlitzsch) and in the St. Louis Public Schools.

St. Louis Age at Nearest Birthday.	BOYS.		GIRLS.		FREIBERG AGE.
	St. Louis.	Freiberg.	St. Louis.	Freiberg.	
	±	±	±	±	
6	3.40 cm.	3.4488 cm.	3.42 cm.	3.5926 cm.	6½ to 7 yrs.
7	3.61 "	3.5841 "	3.75 "	3.7362 "	7 - 8 "
8	3.89 "	3.8546 "	3.70 "	3.8293 "	8 - 9 "
9	3.75 "	4.0067 "	3.83 "	3.7785 "	9 - 10 "
10	3.98 "	4.2181 "	4 06 "	4.2265 "	10 - 11 "
11	4 23 "	4.2434 "	4.48 "	4.4125 "	11 - 12 "
12	4.47 "	4.5984 "	5.23 "	4.8013 "	12 - 13 "
13	4.98 "	4.7844 "	5.46 "	5.2155 "	13 - 14 "
14	5.58 "	5.1479 "	5.15 "	4.8520 "	over 14 "
15	6.33 "		4.01 "		
16	5.87 "		4.05 "		
17	5.15 "		3.45 "		
18	4.98 "		3 39 "		
19			4.04 "		
20			3.14 "		
21			4 27 "		

The agreement between the series is satisfactory and demonstrates the stability of the method as well as the accuracy with which it has been employed in these particular instances. The coincidence is the more significant because the St. Louis children are taller than the Freiberg children.

TABLE No. 2.

A Comparison of the Average Height Standing of School Children in the Freiberg School District (Geissler and Uhlitzsch) and in the St. Louis Public Schools.

St. Louis Age at Nearest Birthday.	BOYS.		GIRLS.		FREIBERG AGE.
	St. Louis.	Freiberg.	St. Louis.	Freiberg.	
6	108.94 cm.	108.6 cm.	107.67 cm.	107.9 cm.	6½ to 7 yrs.
7	114.03 "	112.6 "	112.95 "	112.0 "	7 - 8 "
8	119.13 "	117.6 "	118.36 "	116.7 "	8 - 9 "
9	124.35 "	122.1 "	123.67 "	121.5 "	9 - 10 "
10	128.87 "	126.7 "	128.43 "	126.1 "	10 - 11 "
11	133.84 "	130.6 "	133.19 "	131.0 "	11 - 12 "
12	138.21 "	135.5 "	139.11 "	135.5 "	12 - 13 "
13	142.91 "	140.1 "	146.53 "	141.6 "	13 - 14 "
14	148.58 "	144.1 "	150.84 "	145.5 "	over 14
15	154.90 "		155.04 "		
16	160.27 "		157.52 "		
17	165.13 "		159.33 "		
18	170.41 "		159.42 "		
19			158.46 "		
20			159.41 "		
21			159.98 "		

It follows from table No. 1 that *The Physiological Difference between individual school children and the Physical Type of their sex and age is essentially the same, where the differences between the children compared are not greater than those existing between the St. Louis and the Freiberg children.*

The material now to be discussed is presented in Tables No. 6, 7 and 8 and consists of the Number of Observations, Average, Probable Error of Average, Probable Deviation, Relative Annual Increase of Average and Relation of Probable Deviation to Average of Weight in indoor clothing, Height standing without shoes, Height Sitting, *i. e.*, height from the crown of the head to the chair on which the child sits erect, Span of Arms, or distance between the tips of the middle fingers when the arms are extended in a plane with the shoulders, and Girth of Chest, obtained by adding the girth of the chest on a level with the nipples at full inspiration to the girth at full expiration and dividing by 2, the measurement being made over the boys' shirts and the girls' dresses, the corsets occasionally worn by American school girls being previously removed. The manner of making the measurements is fully described in the author's work On the Growth of St. Louis Children, about to be published by the Academy of Science of St. Louis.

The Absolute Probable Deviation from the Average is given in Table No. 3, extracted from Tables No. 6, 7 and 8. The total deviation of the five dimensions meas-

TABLE No. 3.

THE ABSOLUTE PROBABLE DEVIATION FROM THE AVERAGE: $d \doteq \pm 0.8453 \frac{\Sigma \delta}{n}$

Dimension.	Sex.	Age at nearest Birthday and Absolute Probable Deviation from Average.															
		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		±	±	±	±	±	±	±	±	±	±	±	±	±	±	±	±
Weight	**Boys.**	**1.43**	**1.68**	**1.96**	**2.09**	**2.23**	**2.60**	**2.46**	**3.88**	**4.56**	**5.06**	**6.16**	**4.38**				
	Girls.	1.44	1.88	1.95	2 23	2.31	2.91	3.31	4.22	4.67	4.05	4.24	3.70	3.60	3.76	3.76	
Height Standing.	**Boys.**	**3.40**	**3.61**	**3.89**	**3.75**	**3.98**	**4.23**	**4.47**	**4.98**	**5.58**	**6.33**	**5.87**	**5.15**	**4.98**			
	Girls.	3.42	3.75	3.70	3.83	4.06	4.48	5.23	5.46	5.15	4.01	4.05	3.45	3.39	4.04	3.14	4.27
Height Sitting	**Boys.**	**2.32**	**2.64**	**2.26**	**2.34**	**2.42**	**2.56**	**2.72**	**2.74**	**3.15**	**3.59**	**3.48**	**3.77**	**2.89**			
	Girls.	2.03	2.19	2.04	2.11	2.19	2.37	2.61	2.87	3.11	2.54	2.36	2.17	1.72	1.82	2.03	1.86
Span of Arms.	**Boys.**	**3.85**	**4.16**	**4.18**	**4.25**	**4.70**	**4.84**	**4.57**	**5.71**	**6.03**	**7.15**	**7.89**	**5.03**	**4.31**			
	Girls.	3.87	4.18	4.28	4.18	4.69	4.87	4.51	5.55	5.29	4.58	4.41	4.05	4.28	4.71	4.13	4.33
Girth of Chest*	**Boys.**	**2.22**	**2.38**	**2.35**	**2.51**	**2.72**	**2.61**	**2.94**	**3.11**	**3.58**	**3.77**	**4.19**	**3.15**	**2.94**			
	Girls.	2.48	2.47	2.40	2.53	2.67	3.04	3.24	3.54	3.65	3.70	3.27	3.34	3.23			
Total ..	**Boys.**	**13.72**	**14.47**	**14.64**	**14.94**	**15.05**	**16.84**	**17.16**	**20.42**	**22.90**	**25.90**	**27.59**	**21.48**				
	Girls.	13.24	14.47	14.37	14.88	15.92	17.67	18.90	21.64	21.87	18.88	18.33	16.71	16.22			

* Obtained by adding Girth of Chest at full Inspiration to Girth of Chest at full Expiration and dividing by 2.

ured at each age is also stated, in order to secure a more accurate general view. It is seen that the total Absolute Probable Deviation increases continuously from age 6 to age 16 in boys and from age 6 to age 15 in girls (except at age 8), after which periods there is a fall. The increase is not uniform, becoming suddenly much greater at age 13 in boys and age 11 in girls, the accelerated increase extending over four years in both sexes and ending as suddenly as it began.

It has been already said that the Absolute Probable Deviation is entangled with the size of the individual. In Table No. 4 this obstacle has been removed and the Physiological Difference of Individual from Type appears. A comparison

TABLE No. 4.

THE RELATION OF PROBABLE DEVIATION (d) TO AVERAGE (A). $\frac{d}{A}$.

Dimension.	Sex.	Age at Nearest Birthday and Relation of Probable Deviation to Average.															
		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Weight	**Boys.**	**7.2**	**7.8**	**8.2**	**8.0**	**7.9**	**8.4**	**7.3**	**10.6**	**11.3**	**11.0**	**12.0**	**7.9**	**6.9**			
	Girls.	7.6	9.0	8.5	8.9	8.4	9.6	9.8	11.0	11.0	8.7	8.4	7.0	6.9	7.2	7.0	
Height Standing.	**Boys.**	**3.1**	**3.2**	**3.3**	**3.0**	**3.1**	**3.2**	**3.2**	**3.5**	**3.8**	**4.1**	**3.7**	**3.1**	**2.8**			
	Girls.	3.2	3.3	3.1	3.1	3.1	3.2	3.4	3.8	3.7	3.4	2.6	2.2	2.1	2.6	2.0	2.7
Height Sitting.	**Boys.**	**4.6**	**4.2**	**3.5**	**3.5**	**3.5**	**3.6**	**3.8**	**3.7**	**4.1**	**4.5**	**4.2**	**4.4**	**3.3**			
	Girls.	3.4	3.5	3.2	3.2	3.2	3.4	3.6	3.8	4.0	3.1	2.8	2.6	2.0	2.1	2.4	2.2
Span of Arms.	**Boys.**	**3.5**	**3.6**	**3.5**	**3.4**	**3.6**	**3.6**	**3.2**	**3.9**	**4.0**	**4.5**	**4.8**	**3.0**	**2.5**			
	Girls.	3.6	3.7	3.6	3.4	3.6	3.6	3.2	3.8	3.5	2.9	2.8	2.5	2.7	2.9	2.6	2 7
Girth of Chest*	**Boys.**	**3.8**	**3.9**	**3.8**	**3.9**	**4.1**	**3.9**	**4.3**	**4.4**	**4.9**	**4.9**	**5.3**	**3.9**	**3.5**			
	Girls.	4.3	4.2	3.9	4.0	4.2	4.6	4.7	5.0	4.9	4.7	4.1	4.2	4.0			
Total....	**Boys.**	**22.2**	**22.7**	**22.3**	**21.8**	**22.2**	**22.2**	**21.8**	**26.1**	**28.1**	**29.0**	**30.0**	**22.3**	**19.0**			
	Girls.	22.1	23.7	22.3	22.6	22.5	24.4	24.7	27.4	27.1	22.8	20.7	18.5	17.7			

*** Obtained by adding Girth of Chest at full Inspiration to Girth of Chest at full Expiration and dividing by 2.**

of this table with the preceding one is very instructive. The continuous increase observed in the Absolute Probable Deviation has disappeared Indeed the total Deviation at age 12 is less than at age 7. An important increase occurs in the years 13, 14, 15 and 16 in boys and 11, 12, 13 and 14 in girls. During these four years in each sex, the Physiological Difference of the Individual from the Type is greater than at any other time. Hence this difference does not increase with the age of the Type or with its size. The true relation of the Physiological Difference is made plain by a comparison of Relative Probable Deviation with Relative Annual Increase of Average

TABLE No. 5.

The Relative Annual Increase of Average.*

Dimension.	Sex.	Age at nearest Birthday and Relative Annual Increase of Average.											
		6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	12 to 13	13 to 14	14 to 15	15 to 16	16 to 17	17 to 18
Weight...........	**Boys.**	**9.7**	**9.7**	**9.6**	**8.7**	**9.5**	**8.1**	**9.3**	**10.5**	**14.3**	**11.6**	**7.9**	**5.3**
	Girls.	10.0	9.9	9.6	9.6	9.7	11.6	14.3	9.9	10.4	7.6	4.7	
Height Standing..	**Boys.**	**4.7**	**4.7**	**4.4**	**3.6**	**3.9**	**3.3**	**3.4**	**4.0**	**4.3**	**3.5**	**3.0**	**3.2**
	Girls.	4.9	4.8	4.5	3.9	3.7	4.4	5.3	2.9	2.8	1.6	1.1	0.06
Height Sitting....	**Boys.**	**3.3**	**2.2**	**3.1**	**3.8**	**2.1**	**2.7**	**2.3**	**3.6**	**3.8**	**3.2**	**4.1**	**3.1**
	Girls.	4.1	3.5	3.4	3.1	2.7	3.8	4.6	3.5	3.5	2.9	1.1	0.6
Span of Arms.....	**Boys.**	**5.0**	**4.9**	**4.3**	**4.0**	**3.8**	**4.1**	**3.2**	**4.3**	**4.7**	**3.5**	**2.8**	**4.0**
	Girls.	5.0	5.3	4.5	4.1	4.3	4.3	5.1	3.7	2.5	1.4	3.2	0.9
Girth of Chest†...	**Boys.**	**2.7**	**2.6**	**2.8**	**2.6**	**2.5**	**2.3**	**2.7**	**3.8**	**4.5**	**3.5**	**2.7**	**3.8**
	Girls.	1.9	2.3	2.8	0.8	4.5	3.8	4.3	4.0	3.6	2.7	2.0	0.1
Total...........	**Boys.**	**25.4**	**24.1**	**24.2**	**22.7**	**21.8**	**20.5**	**20.9**	**26.2**	**31.6**	**25.3**	**20.5**	**19.4**
	Girls.	25.9	25.8	24.8	21.5	24.9	27.9	33.6	24.0	22.8	16.2	12.1	1.7

* Obtained for age 6 to 7 by dividing the increase from age 6 to age 7 by the average at age 6; for age 7 to 8 by dividing the increase from age 7 to age 8 by the average at age 7; and so on.

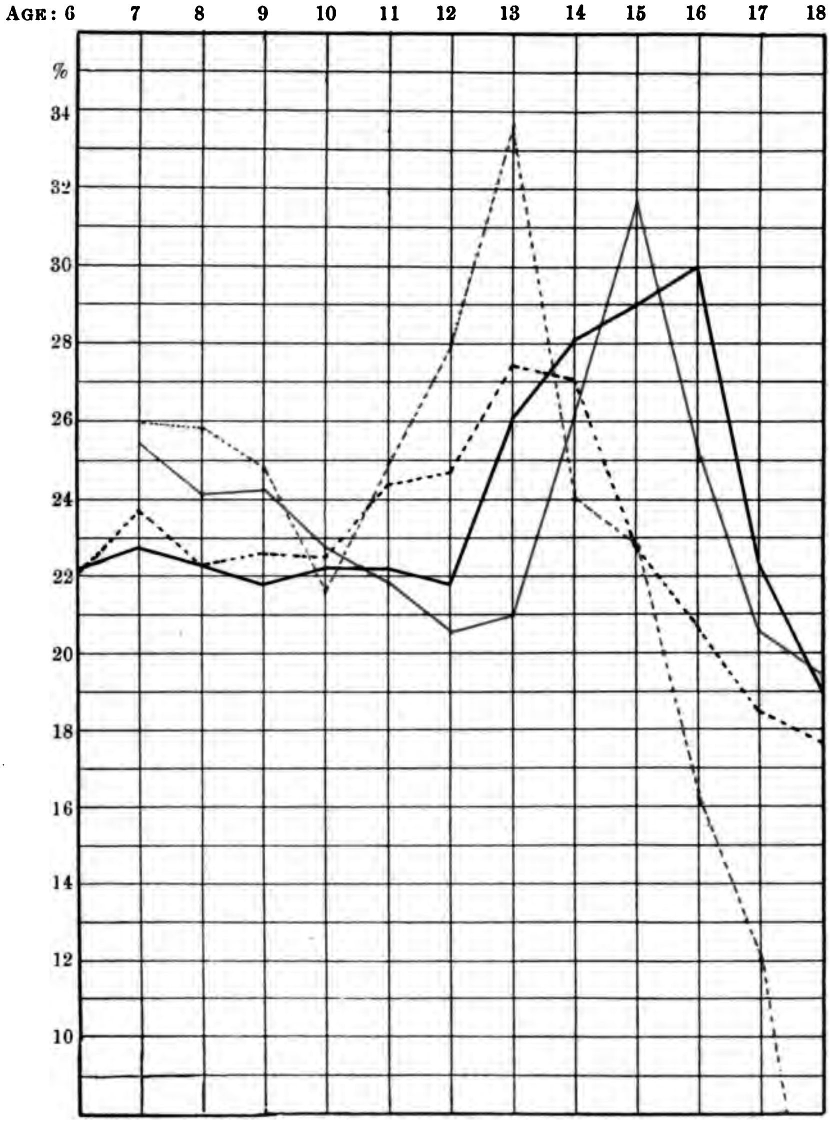
† Obtained by adding Girth of chest at full inspiration to Girth of chest at full expiration and dividing by 2.

or quickness of growth, given in Table No. 5. The comparison is made easy by arranging the totals side by side. The

AGE.	Relative Probable Deviation.	Relative Increase of Average.	Relative Probable Deviation.	Relative Increase of Average.
	BOYS.	BOYS.	GIRLS.	GIRLS.
6	22.2	....	22.1	....
7	22.7	25.4	23.7	25.9
8	22.3	24.1	22.3	25.8
9	21.8	24.2	22.6	24.8
10	22 2	22.7	22.5	21.5
11	22.2	21.8	**24.4**	**24.9**
12	21.8	20.5	**24.7**	**27.9**
13	**26.1**	**20.9**	**27.4**	**33.6**
14	**28.1**	**26.2**	**27.1**	**24.0**
15	**29.0**	**31.6**	22.8	22.8
16	**30.0**	**25.8**	20.7	16.2
17	22.8	20.5	18.5	12.1
18	19.0	19.4	17.7	1.7

comparison reveals in both cases a general though not unbroken fall from age 7 to age 13 in boys and 11 in girls, a remarkable increase covering four years in both sexes, and a subsequent great decline. Thus the Relative Deviation coincides in the main with the Quickness of Growth. This relation is shown graphically in Plate I.

The phenomena just described are here seen to advantage. The curve of rate of growth in boys (unbroken red line) falls from age 7 to 12, corresponding to a small fall in Probable Deviation (unbroken black line). At age 12 to 13, a sudden change appears in both curves. They rise rapidly, reach a high maximum and suddenly fall to their former level. The period from the beginning of the rise to the return to the level of age 12 has the same duration in both curves. The maximum deviation is greater in Relative Anuual Increase than in Relative Probable Deviation, a fact in accord with the greater stability of the latter, and the maximum Annual Increase occurs a little earlier than the maximum Probable Deviation. The period of acceleration is more sharply defined in Annual Increase. At age 18, both curves are still falling. The relation between the Rate of Growth



VOL. VI. NO. 10. PLATE I (from Tables No. 4 and 5).

Black: Relative Probable Deviation. **Unbroken Curves: Boys.**
Red: Relative Annual Increase of Average. **Broken Curves: Girls.**

and Probable Deviation is even more clearly seen in the girls' curves (broken lines). The rapid rise begins in them at age 10 to 11, and reaches its maximum at the same age in both curves. The subsequent fall is profound.

The evidence presented above permits the conclusion: *The Physiological Difference between the individual children in an anthropometric series and the Physical Type of the series is directly related to the Quickness of Growth.*

TABLE No. 6.

DATA OF HEIGHT STANDING AND WEIGHT.

Age at Nearest Birthday.	Sex.	Height Standing (In Centimetres). Number of Observations.	Height Standing (In Centimetres). Average. *A*	Height Standing (In Centimetres). Probable Error of Average. *E*	Height Standing (In Centimetres). Probable Deviation. *d*	Height Standing (In Centimetres). Relative Annual Increase of Average.	Height Standing (In Centimetres). Relation of Probable Deviation to Average. $\frac{d}{A}$	Weight (In Kilograms). Number of Observations.	Weight (In Kilograms). Average. *A*	Weight (In Kilograms). Probable Error of Average. *E*	Weight (In Kilograms). Probable Deviation. *d*	Weight (In Kilograms). Relative Annual Increase of Average.	Weight (In Kilograms). Relation of Probable Deviation to Average. $\frac{d}{A}$
				±	±	%	%			±	±	%	%
Six	**Boys.**	**709**	**108.94**	**0.128**	**3.40**		**3.1**	**707**	**19.75**	**0.054**	**1.43**		**7.2**
	Girls.	780	107.67	0.123	3 42		3.2	798	18.93	0.051	1.44		7.6
Seven	**Boys.**	**1850**	**114.03**	**0.084**	**3.61**	**4.7**	**3.2**	**1814**	**21.67**	**0.039**	**1.68**	**9.7**	**7.8**
	Girls.	1791	112.95	0.089	3.75	4.9	3.3	1714	20.82	0.045	1.88	10.0	9.0
Eight	**Boys.**	**2223**	**119.13**	**0.082**	**3.89**	**4.7**	**3.3**	**2188**	**23.78**	**0.042**	**1.96**	**9.7**	**8.2**
	Girls.	2193	118.36	0.079	3.70	4.8	3.1	2147	22.88	0.042	1.95	9.9	8.5
Nine	**Boys.**	**2205**	**124.35**	**0.080**	**3.75**	**4.4**	**3.0**	**2188**	**26.06**	**0.045**	**2.09**	**9.6**	**8.0**
	Girls.	2122	123.67	0.065	3.83	4.5	3.1	2055	25.08	0.049	2.23	9.6	8.9
Ten	**Boys.**	**2087**	**128.87**	**0.087**	**3.98**	**3.6**	**3.1**	**2064**	**28.32**	**0.049**	**2.28**	**8.7**	**7.9**
	Girls.	2053	128.43	0.089	4.06	3.9	3.1	1947	27.49	0.052	2.31	9.6	8.4
Eleven	**Boys.**	**1819**	**133.84**	**0.099**	**4.23**	**3.9**	**3.2**	**1743**	**31.00**	**0.062**	**2.60**	**9.5**	**8.4**
	Girls.	1772	133.19	0.106	4.48	3.7	3.2	1708	30.15	0.070	2.91	9.7	9.6
Twelve	**Boys.**	**1658**	**138.21**	**0.116**	**4.47**	**3.3**	**3.2**	**1644**	**33.51**	**0.061**	**2.46**	**8.1**	**7.3**
	Girls.	1732	139.11	0.098	5.23	4.4	3.4	1676	33.66	0.081	3.31	11.6	9.8
Thirteen	**Boys.**	**1268**	**142.91**	**0.140**	**4.98**	**3.4**	**3.5**	**1242**	**36.61**	**0.110**	**3.88**	**9.3**	**10.6**
	Girls.	1322	146.53	0.150	5.46	5.3	3.8	1343	38.49	0.115	4.22	14.3	11.0
Fourteen	**Boys.**	**925**	**148.58**	**0.183**	**5.58**	**4.0**	**3.8**	**946**	**40.44**	**0.148**	**4.56**	**10.5**	**11.3**
	Girls.	1085	150.84	0.156	5.15	2.9	3.7	1082	42.29	0.142	4.67	9.9	11.0
Fifteen	**Boys.**	**490**	**154.90**	**0.286**	**6.33**	**4.3**	**4.1**	**498**	**46.22**	**0.227**	**5.06**	**14.3**	**11.0**
	Girls.	680	155.04	0.154	4.01	2.8	3.4	690	46.69	0.154	4.05	10.4	8.7
Sixteen	**Boys.**	**189**	**160.27**	**0.427**	**5.87**	**3.5**	**3.7**	**203**	**51.60**	**0.431**	**6.16**	**11.6**	**12.0**
	Girls.	420	157.52	0.197	4.05	1.6	2.6	420	50.25	0.207	4.24	7.6	8.4
Seventeen	**Boys.**	**78**	**165.13**	**0.592**	**5.15**	**3.0**	**3.1**	**71**	**55.67**	**0.521**	**4.38**	**7.9**	**7.9**
	Girls.	206	159.33	0.241	3.45	1.1	2.2	230	52.61	0.244	3.70	4.7	7.0
Eighteen	**Boys.**	**29**	**170.41**	**0.924**	**4.98**	**3.2**	**2.8**	**17**	**58.64**			**5.3**	
	Girls.	164	159.42	0.265	3.39	0.06	2.1	155	52.36	0.289	3.60		6.9
Nineteen	Girls.	85	158.46	0.438	4.04		2.6	81	52.19	0.332	3.76		7.2
Twenty	Girls.	79	159.41	0.346	3.14		2.0	66	53.91	0.565	3.76		7.0
Twenty-one	Girls.	43	159.98	0.651	4.27		2.7						

TABLE No. 7.

DATA OF HEIGHT SITTING AND SPAN OF ARMS.

Age at Nearest Birthday.	Sex.	Height Sitting (In Centimetres).						Span of Arms (In Centimetres).					
		Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$	Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$
				±	±	%	%			±	±	%	%
Six..............	**Boys.**	**714**	**61.31**	**0.105**	**2.82**		**4.6**	**708**	**108.95**	**0.144**	**3.85**		**3.5**
	Girls.	751	59.45	0.132	2.03		3.4	769	106.96	0.140	3.87		3.6
Seven..............	**Boys.**	**1853**	**63.32**	**0.061**	**2.64**	**3.3**	**4.2**	**1862**	**114.42**	**0.096**	**4.16**	**5.0**	**3.6**
	Girls.	1727	61.80	0.053	2.19	4.1	3.5	1724	112.36	0.107	4.18	5.0	3.7
Eight..............	**Boys.**	**2239**	**64.74**	**0.048**	**2.26**	**2.2**	**3.5**	**2234**	**120.07**	**0.088**	**4.18**	**4.9**	**3.5**
	Girls.	2120	63.97	0.044	2.04	3.5	3.2	2152	118.33	0.092	4.28	5.3	3.6
Nine..............	**Boys.**	**2258**	**66.73**	**0.049**	**2.34**	**3.1**	**3.5**	**2272**	**125.18**	**0.089**	**4.25**	**4.3**	**3.4**
	Girls.	2071	66.16	0.046	2.11	3.4	3.2	2065	123.63	0.092	4.18	4.5	3.4
Ten..............	**Boys.**	**2118**	**69.25**	**0.040**	**2.42**	**3.8**	**3.5**	**2076**	**130.22**	**0.103**	**4.70**	**4.0**	**3.6**
	Girls.	2037	68.19	0.049	2.19	3.1	3.2	2045	128.75	0.104	4.69	4.1	3.6
Eleven..............	**Boys.**	**1828**	**70.67**	**0.060**	**2.56**	**2.1**	**3.6**	**1810**	**135.13**	**0.113**	**4.84**	**3.8**	**3.6**
	Girls.	1748	70.03	0.057	2.37	2.7	3.4	1757	134.24	0.116	4.87	4.3	3.6
Twelve..............	**Boys.**	**1656**	**72.55**	**0.067**	**2.72**	**2.7**	**3.8**	**1664**	**140.60**	**0.112**	**4.57**	**4.1**	**3.2**
	Girls.	1707	72.67	0.063	2.61	3.8	3.6	1718	140.07	0.109	4.51	4.3	3.2
Thirteen..............	**Boys.**	**1285**	**74.20**	**0.076**	**2.74**	**2.3**	**3.7**	**1281**	**145.09**	**0.159**	**5.71**	**3.2**	**3.9**
	Girls.	1354	76.03	0.078	2.87	4.6	3.8	1868	147.19	0.150	5.55	5.1	3.8
Fourteen..............	**Boys.**	**936**	**76.84**	**0.103**	**3.15**	**3.6**	**4.1**	**934**	**151.28**	**0.197**	**6.03**	**4.3**	**4.0**
	Girls.	1065	78.68	0.095	3.11	3.5	4.0	1088	152.58	0.160	5.29	3.7	3.5
Fifteen..............	**Boys.**	**498**	**79.74**	**0.161**	**3.59**	**3.8**	**4.5**	**495**	**158.43**	**0.321**	**7.15**	**4.7**	**4.5**
	Girls.	674	81.42	0.098	2.54	3.5	3.1	677	156.38	0.176	4.58	2.5	2.9
Sixteen..............	**Boys.**	**193**	**82.28**	**0.250**	**3.48**	**3.2**	**4.2**	**189**	**163.96**	**0.574**	**7.89**	**3.5**	**4.8**
	Girls.	411	83.76	0.116	2.36	2.9	2.8	413	158.51	0.217	4.41	1.4	2.8
Seventeen..............	**Boys.**	**77**	**85.68**	**0.427**	**3.77**	**4.1**	**4.4**	**75**	**168.56**	**0.581**	**5.03**	**2.8**	**3.0**
	Girls.	202	84.66	0.153	2.17	1.1	2.6	202	159.01	0.285	4.05	3.2	2.5
Eighteen..............	**Boys.**	**31**	**88.23**	**0.536**	**2.89**	**3.1**	**3.3**	**82**	**175.31**	**0.761**	**4.31**	**4.0**	**2.5**
	Girls.	167	85.20	0.133	1.72	0.6	2.0	164	160.47	0.334	4.28	0.9	2.7
Nineteen..............	Girls.	85	84.86	0.198	1.82		2.1	83	158.45	0.517	4.71		2.9
Twenty..............	Girls.	78	85.31	0.230	2.03		2.4	76	160.17	0.474	4.13		2.6
Twenty-one..............	Girls.	41	85.05	0.290	1.86		2.2	37	161.27	0.712	4.33		2.7

TABLE No. 6.

DATA OF HEIGHT STANDING AND WEIGHT.

Age at Nearest Birthday.	Sex.	Height Standing (In Centimetres).						Weight (In Kilograms).					
		Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$	Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation o Probable Deviation to Average. $\frac{d}{A}$
				±	±	%	%			±	±	%	%
Six …………	**Boys.**	**709**	**108.94**	**0.128**	**3.40**		**3.1**	**707**	**19.75**	**0.054**	**1.43**		**7.2**
	Girls.	780	107.67	0.123	3 42		3.2	798	18.93	0.051	1.44		7.6
Seven …………	**Boys.**	**1850**	**114.03**	**0.084**	**3.61**	**4.7**	**3.2**	**1814**	**21.67**	**0.039**	**1.68**	**9.7**	**7.8**
	Girls.	1791	112.95	0.089	3.75	4.9	3.3	1714	20.82	0.045	1.88	10.0	9.0
Eight…………	**Boys.**	**2223**	**119.13**	**0.082**	**3.89**	**4.7**	**3.3**	**2188**	**23.78**	**0.042**	**1.96**	**9.7**	**8.2**
	Girls.	2193	118.36	0.079	3.70	4.8	3.1	2147	22.88	0.042	1.95	9.9	8.5
Nine…………	**Boys.**	**2205**	**124.35**	**0.080**	**3.75**	**4.4**	**3.0**	**2188**	**26.06**	**0.045**	**2.09**	**9.6**	**8.0**
	Girls.	2122	123.67	0.065	3.83	4.5	3.1	2055	25.08	0.049	2.23	9.6	8.9
Ten…………	**Boys.**	**2087**	**128.87**	**0.087**	**3.98**	**3.6**	**3.1**	**2064**	**28.32**	**0.049**	**2.23**	**8.7**	**7.9**
	Girls.	2053	128.43	0.089	4.06	3.9	3.1	1947	27.49	0.052	2.31	9.6	8.4
Eleven…………	**Boys.**	**1819**	**133.84**	**0.099**	**4.28**	**3.9**	**3.2**	**1743**	**31.00**	**0.062**	**2.60**	**9.5**	**8.4**
	Girls.	1772	133.19	0.106	4.48	3.7	3.2	1708	30.15	0.070	2.91	9.7	9.6
Twelve…………	**Boys.**	**1658**	**138.21**	**0.116**	**4.47**	**3.3**	**3.2**	**1644**	**33.51**	**0.061**	**2.46**	**8.1**	**7.3**
	Girls.	1732	139.11	0.098	5.23	4.4	3.4	1676	33.66	0.081	3.31	11.6	9.8
Thirteen…………	**Boys.**	**1268**	**142.91**	**0.140**	**4.98**	**3.4**	**3.5**	**1242**	**36.61**	**0.110**	**3.88**	**9.3**	**10.6**
	Girls.	1322	146.53	0.150	5.46	5.3	3.8	1343	38.49	0.115	4.22	14.3	11.0
Fourteen…………	**Boys.**	**925**	**148.58**	**0.183**	**5.58**	**4.0**	**3.8**	**946**	**40.44**	**0.148**	**4.56**	**10.5**	**11.3**
	Girls.	1085	150.84	0.156	5.15	2.9	3.7	1082	42.29	0.142	4.67	9.9	11.0
Fifteen…………	**Boys.**	**490**	**154.90**	**0.286**	**6.33**	**4.3**	**4.1**	**498**	**46.22**	**0.227**	**5.06**	**14.3**	**11.0**
	Girls.	680	155.04	0.154	4.01	2.8	3.4	690	46.69	0.154	4.05	10.4	8.7
Sixteen…………	**Boys.**	**189**	**160.27**	**0.427**	**5.87**	**3.5**	**3.7**	**208**	**51.60**	**0.431**	**6.16**	**11.6**	**12.0**
	Girls.	420	157.52	0.197	4.05	1.6	2.6	420	50.25	0.207	4.24	7.6	8.4
Seventeen…………	**Boys.**	**78**	**165.13**	**0.592**	**5.15**	**3.0**	**3.1**	**71**	**55.67**	**0.521**	**4.38**	**7.9**	**7.9**
	Girls.	206	159.33	0.241	3.45	1.1	2.2	230	52.61	0.244	3.70	4.7	7.0
Eighteen…………	**Boys.**	**29**	**170.41**	**0.924**	**4.98**	**3.2**	**2.8**	**17**	**58.64**			**5.3**	
	Girls.	164	159.42	0.265	3.39	0.06	2.1	155	52.36	0.289	3.60		6.9
Nineteen…………	Girls.	85	158.46	0.438	4.04		2.6	81	52.19	0.332	3.76		7.2
Twenty…………	Girls.	79	159.41	0.346	3.14		2.0	66	53.91	0.565	3.76		7.0
Twenty-one…………	Girls.	43	159.98	0.651	4.27		2.7						

TABLE No. 7.

Data of Height Sitting and Span of Arms.

Age at Nearest Birthday.	Sex.	Height Sitting (In Centimetres).						Span of Arms (In Centimetres).					
		Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$	Number of Observations.	Average. A	Probable Error of Average. E	Probable Deviation. d	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$
				±	±	%	%			±	±	%	%
Six..............	**Boys.**	**714**	**61.31**	**0.105**	**2.82**		**4.6**	**708**	**108.95**	**0.144**	**3.85**		**3.5**
	Girls.	751	59.45	0.132	2.03		3.4	769	106.96	0.140	3.87		3.6
Seven............	**Boys.**	**1853**	**63.32**	**0.061**	**2.64**	**3.3**	**4.2**	**1862**	**114.42**	**0.096**	**4.16**	**5.0**	**3.6**
	Girls.	1727	61.80	0.053	2.19	4.1	3.5	1724	112.36	0.107	4.18	5.0	3.7
Eight............	**Boys.**	**2239**	**64.74**	**0.048**	**2.26**	**2.2**	**3.5**	**2234**	**120.07**	**0.088**	**4.18**	**4.9**	**3.5**
	Girls.	2120	63.97	0.044	2.04	3.5	3.2	2152	118.33	0.092	4.28	5.3	3.6
Nine.............	**Boys.**	**2258**	**66.73**	**0.049**	**2.34**	**3.1**	**3.5**	**2272**	**125.18**	**0.089**	**4.25**	**4.3**	**3.4**
	Girls.	2071	66.16	0.046	2.11	3.4	3.2	2065	123.63	0.092	4.18	4.5	3.4
Ten..............	**Boys.**	**2118**	**69.25**	**0.040**	**2.42**	**3.8**	**3.5**	**2076**	**130.22**	**0.103**	**4.70**	**4.0**	**3.6**
	Girls.	2037	68.19	0.049	2.19	3.1	3.2	2045	128.75	0.104	4.69	4.1	3.6
Eleven...........	**Boys.**	**1828**	**70.67**	**0.060**	**2.56**	**2.1**	**3.6**	**1810**	**135.13**	**0.113**	**4.84**	**3.8**	**3.6**
	Girls.	1748	70.03	0.057	2.37	2.7	3.4	1757	134.24	0.116	4.87	4.3	3.6
Twelve...........	**Boys.**	**1656**	**72.55**	**0.067**	**2.72**	**2.7**	**3.8**	**1664**	**140.60**	**0.112**	**4.57**	**4.1**	**3.2**
	Girls.	1707	72.67	0.063	2.61	3.8	3.6	1718	140.07	0.109	4.51	4.3	3.2
Thirteen.........	**Boys.**	**1285**	**74.20**	**0.076**	**2.74**	**2.3**	**3.7**	**1281**	**145.09**	**0.159**	**5.71**	**3.2**	**3.9**
	Girls.	1354	76.03	0.078	2.87	4.6	3.8	1368	147.19	0.150	5.55	5.1	3.8
Fourteen.........	**Boys.**	**936**	**76.84**	**0.103**	**3.15**	**3.6**	**4.1**	**934**	**151.28**	**0.197**	**6.03**	**4.3**	**4.0**
	Girls.	1065	78.68	0.095	3.11	3.5	4.0	1088	152.58	0.160	5.29	3.7	3.5
Fifteen..........	**Boys.**	**498**	**79.74**	**0.161**	**3.59**	**3.8**	**4.5**	**495**	**158.43**	**0.321**	**7.15**	**4.7**	**4.5**
	Girls.	674	81.42	0.098	2.54	3.5	3.1	677	156.38	0.176	4.58	2.5	2.9
Sixteen..........	**Boys.**	**193**	**82.28**	**0.250**	**3.48**	**3.2**	**4.2**	**189**	**163.96**	**0.574**	**7.89**	**3.5**	**4.8**
	Girls.	411	83.76	0.116	2.36	2.9	2.8	413	158.51	0.217	4.41	1.4	2.8
Seventeen........	**Boys.**	**77**	**85.68**	**0.427**	**3.77**	**4.1**	**4.4**	**75**	**168.56**	**0.581**	**5.03**	**2.8**	**3.0**
	Girls.	202	84.66	0.153	2.17	1.1	2.6	202	159.01	0.285	4.05	3.2	2.5
Eighteen.........	**Boys.**	**31**	**88.23**	**0.536**	**2.89**	**3.1**	**3.3**	**32**	**175.31**	**0.761**	**4.31**	**4.0**	**2.5**
	Girls.	167	85.20	0.133	1.72	0.6	2.0	164	160.47	0.334	4.28	0.9	2.7
Nineteen.........	Girls.	85	84.86	0.198	1.82		2.1	83	158.45	0.517	4.71		2.9
Twenty...........	Girls.	78	85.31	0.230	2.03		2.4	76	160.17	0.474	4.13		2.6
Twenty-one.......	Girls.	41	85.05	0.290	1.86		2.2	37	161.27	0.712	4.33		2.7

TABLE No. 8.

DATA OF GIRTH OF CHEST.

Age at Nearest Birthday.	Sex.	Girth of Chest* (In Centimetres). Number of Observations.	Average. *A*	Probable Error of Average. *E*	Probable Deviation. *d*	Relative Annual Increase of Average.	Relation of Probable Deviation to Average. $\frac{d}{A}$
				±	±	%	%
Six	**Boys.**	**677**	**59.05**	**0.083**	**2.22**		**3.8**
	Girls.	741	58.34	0.091	2.48		4.3
Seven	**Boys.**	**1708**	**60.62**	**0.057**	**2.38**	**2.7**	**3.9**
	Girls.	1681	59.47	0.062	2.47	1.9	4.2
Eight	**Boys.**	**2095**	**62.18**	**0.052**	**2.35**	**2.6**	**3.8**
	Girls.	2040	60.81	0.053	2.40	2.3	3.9
Nine	**Boys.**	**2120**	**63.90**	**0.055**	**2.51**	**2.8**	**3.9**
	Girls.	1966	62.51	0.057	2.53	2.8	4.0
Ten	**Boys.**	**1997**	**65.59**	**0.061**	**2.72**	**2.6**	**4.1**
	Girls.	1893	63.02	0.061	2.67	0.8	4.2
Eleven	**Boys.**	**1732**	**67.24**	**0.063**	**2.61**	**2.5**	**3.9**
	Girls.	1654	65.85	0.075	3.04	4.5	4.6
Twelve	**Boys.**	**1565**	**68.76**	**0.074**	**2.94**	**2.3**	**4.3**
	Girls.	1624	68.34	0.081	3.24	3.8	4.7
Thirteen	**Boys.**	**1228**	**70.61**	**0.089**	**3.11**	**2.7**	**4.4**
	Girls.	1313	71.29	0.098	3.54	4.3	5.0
Fourteen	**Boys.**	**925**	**73.27**	**0.118**	**3.58**	**3.8**	**4.9**
	Girls.	1020	74.13	0.114	3.65	4.0	4.9
Fifteen	**Boys.**	**498**	**76.56**	**0.169**	**3.77**	**4.5**	**4.9**
	Girls.	659	76.78	0.143	3.70	3.6	4.7
Sixteen	**Boys.**	**205**	**79.22**	**0.293**	**4.19**	**3.5**	**5.3**
	Girls.	397	78.85	0.164	3.27	2.7	4.1
Seventeen	**Boys.**	**80**	**81.39**	**0.353**	**3.15**	**2.7**	**3.9**
	Girls.	206	80.39	0.233	3.34	2.0	4.2
Eighteen	**Boys.**	**31**	**84.52**	**0.528**	**2.94**	**3.8**	**3.5**
	Girls.	162	80.45	0.254	3.23	0.1	4.0

* Obtained by adding Girth of Chest at full Inspiration to Girth of Chest at full Expiration and dividing by 2.

THE GROWTH OF ST. LOUIS CHILDREN.

INTRODUCTION.

In November, 1891, I applied to the Teachers' Committee of the St. Louis Board of Public Schools for permission to make a series of physical measurements of the St. Louis school children. The ends in view were the study of the phenomena of growth, the making of physical standards for each age in the period of school life, and the adjustment of school tasks to the pupil's strength. On the recommendation of Mr. Long, superintendent of the Public Schools, Dr. Hickman and Mr. Walter F. McEntire, at that time chairman of the committee, it was resolved to lay before the Board a statement of the purpose of the measurements and to advise that the permission to make them be granted. This favorable report, for which thanks are due the gentlemen just named, caused the Board to authorize the measurements at its sitting December 8, 1891.

The measurements were collected by what statisticians know as the generalizing method. In the generalizing method, a great number of children is measured once, and the measurements classified according to age. The mean height of the boys or girls at each age is regarded as the height typical of that age. When these typical heights are arranged in order, they show the increase in the height of the type-child during his period of growth and thus express a law of growth. A similar procedure reveals the growth in weight, girth of chest, or any other physical dimension. It is believed that the values got by the generalizing method are the same as would be obtained if a smaller number of children was measured yearly during the growth period. In either case, the accuracy of the result depends on the number of observations at each age, and a high degree of accuracy requires the making of many thousand measurements.

So large an undertaking demands great labor and a considerable expenditure of money. The labor was in the present instance shared by many hands. Most of the measurements were made by the teachers. The measurements of the head and face were made by undergraduates of the St. Louis Medical College. Other members of the same institution were of the greatest service as "special assistants." Messrs. Taussig, Gooden, Soper, Blair, Gross, Schlossstein, Lemen, Loth, Newcomb and Simmons served in this capacity. To their unwearied and long-continued labors and to the support unselfishly given them by their fellow-students the success of the work is chiefly due.

The expense of the investigation was for apparatus, printing and the hire of clerks, and was borne by gentlemen of public spirit in St. Louis. Some of the apparatus was given or loaned free of charge. The Simmons Hardware Company gave callipers and measuring tapes; the Fairbanks Scale Company loaned scales; Mr. F. W. Humphrey loaned a dozen watches; Dr. John Green and Dr. A. E. Ewing gave cards for testing the acuteness of vision, and the Nixon-Jones Printing Company made special rates for printing.

The cordial support of Chancellor Chaplin, Professors H. S. Pritchett, G. Hambach and E. A. Engler of Washington University, the valuable advice of Dr. John B. Shapleigh, and the interest of the Academy of Science of St. Louis are gratefully acknowledged.

The data collected are necessarily of unequal value. Many of the curves constructed from them are highly satisfactory; others present irregularities to be ascribed to an insufficient number of observations at those points. Some investigators have withheld the curves in which such irregularities occur. They have all been printed here, because the wide-spread use of anthropometrical methods in the Public Schools, so much to be desired, seems at present only possible where the measurements are made by the teachers, and it is necessary to know by the examination of the total material of such investigations, what degree of accuracy can be expected.

CHAPTER I.

THE COLLECTION OF THE MEASUREMENTS.

In collecting anthropometrical measurements on a large scale, a systematic working-plan is evidently of much importance. Many things should be borne in mind in making such a plan. The school routine should be disturbed as little as possible; the directions to the measurers should be comprehensive and clear; the apparatus employed should be simple; the measurements should be made during a few months only and in the same season of the year, for the weight of clothing and even the rate of growth differs at different seasons, and measurements collected partly in one season and partly in another cannot be so suitable for comparison as those collected only in the winter or only in the summer; the order in which the schools are visited should be governed by their situation, so that no time may be spent unnecessarily in going and coming; and much care should be taken to collect sufficient data concerning the social condition and the nationality of parents. In short, the construction of a serviceable working-plan for anthropometrical measurements of great numbers of children is a difficult task, and it is to be regretted that the literature is all but barren of suggestions as to the best method of collecting such material. It is hoped for this reason that a description of the methods used in this investigation may be not without value.

The data collected are mentioned in Form A., one of four "forms" employed in this investigation.

Form A.

MALE.

Please Write with Ink.

1. Observer..
2. School..
3. Date..
4. Name of pupil..
5. Place of birth..
6. Age at nearest birthday..

7 In what country was father born ....

8. In what country was mother born ....

9. Occupation of father ....

10. No. of sisters living ....; dead ....

11. No. of brothers living ....; dead ....

12. Residence, No .... Street.

13. Hair	Black. Dark Brown. Light Brown. Red. Flaxen.	14. Eyes	Dark Brown. Light Brown. Blue. Grey.

15. Height standing .... cm.

16. Height sitting .... cm.

17. Span of arms .... cm.

18. Strength of squeeze, right hand .... lbs.

19. Strength of squeeze, left hand .... lbs.

20. Girth of chest, forced expiration .... cm.

21. Girth of chest, forced inspiration .... cm.

22. Weight .... lbs.

23. Acuteness of vision, right eye ....

24. Acuteness of vision, left eye ....

25. Acuteness of hearing, right ear .... ft..... .... in

26. Acuteness of hearing, left ear .... ft................ in.

27. Length of head .... mm.

28. Width of head .... mm.

29. Height of face .... mm.

30. Width of face .... mm.

31. The height of face from the hair line to the point of chin .... mm.

32. Grade ....

Form B was the same as Form A, except that the paper on which it was printed was green instead of white, the color of Form A, and the word "Male" was replaced by the word "Female."

On Jan. 4, 1892, the first school * in the series to be examined began to set down the answers 1, 2, 3, 4, 13, 14, 32, and its pupils were directed to carry home Form C in order that it might be filled by the parents.

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* Pupils were measured in the following schools: Ames, Blair, Blow, Branch High, Bryan Hill, Carr, Carroll, Carr Lane, Central High, Charless, Chouteau, Clay, Clinton, Crow, Divoll, Douglass, Eliot, Elleardsville, Franklin, Garfield, Hamilton, Hodgen, Humboldt, Irving, Jackson, Jefferson, Laclede, Lafayette, Lincoln, Lowell, Lyon, Madison, Maramec, Mullanphy, O'Fallon, Peabody, Penrose, Pestallozzi, Polytechnic, Pope, Shepard, Shields, Spring Avenue, Stoddard, Webster, New Webster. (The "Branches" of the Clinton and other schools are included.)

Form C.

THE PHYSIQUE OF THE SCHOOL CHILDREN IN ST. LOUIS.

The parents or guardians of school children are requested to fill out the following blank, and to return it to the teacher on the next school day:

4. Name of pupil..
5. Place of birth..
6. Age at nearest birthday..
7. In what country was pupil's father born..............................
8. In what country was pupil's mother born..............................
9. Occupation of father..
10. Number of pupil's sisters living..............; dead..................
11. Number of pupil's brothers living............; dead.................
12. Residence of pupil, No.........., ...Street.

On the second day, Form C having been returned, answers 5, 6, 7, 8, 9, 10, 11 and 12 were written. Some ignorant or prejudiced parents refused to answer the questions in Form C and in such cases the answers were obtained as far as possible from the school registers. While the first school was employed in this way on the second day, another school began to answer questions 1, 2, 3, 4 and 32. On the third day, the first school measured the height standing, height sitting and span of arms, while the second school was busy with the second day's work and the third school with the first.

Thus the thirty-two questions were divided into groups, and by the ninth day nine schools were working simultaneously, each on a different group. As soon as one school finished with an apparatus, it was taken to the next school on the list, almost always the nearest in point of distance. An extract from " The Chart of Days " will make this clear.

A PORTION OF "THE CHART OF DAYS."

NAME OF SCHOOL.	SPECIAL ASSISTANT.	RECORD:								
		Answers 1, 2, 3, 4, 13, 14, 32. (Color of Hair and Eyes.)	Answers 5, 6, 7, 8, 9, 10, 11, 12.	Height Standing, Height Sitting, Span of Arms.	Strength of Squeeze.	Girth of Chest.	Weight.	Acuteness of Vision.	Acuteness of Hearing.	Head Measurements.
Laclede..........	Lemen.......	4*	5	7	8	11	12	13	14	15
Madison and New Madison........	Simmons.....	5	6	8	11	12	13	14	15	18
Pestalozzi.........	Newcomb.....	6	7	11	12	13	14	15	18	19
Carroll...........	Loth.........	7	8	12	13	14	15	18	19	20
Lafayette and Lafayette Branch..	Taussig......	8	11	13	14	15	18	19	20	21
Humboldt........	Gooden......	11	12	14	15	18	19	20	21	22
Lyon.............	Soper........	12	13	15	18	19	20	21	22	25
Shepard...	Blair.........	13	14	18	19	20	21	22	25	26
Meramec.........	Gross........	14	15	19	20	21	22	25	26	27
Blow and Blow Branch.........	Schlossstein..	15	18	20	21	22	25	26	27	....

The Laclede School began Jan. 4 and finished Jan. 15, the Madison School began Jan. 5 and finished Jan. 18, and so through the list.

Nearly nine thousand pupils were examined each school-day after the ninth, and each day saw the returns of nearly a thousand pupils completed. The collection of material was finished in fifty-four school-days, beginning Jan. 4 and ending March 18. During this period of about 11 weeks, 18059 girls and 16295 boys were examined† and nearly one million data collected, about five hundred thousand of which were measurements, a result which would hardly have been possible without the strenuous exertions of my assistants.

One of the Special Assistants mentioned in the Chart of Days was assigned to each school under investigation. It was his duty to visit the school every day for the purpose of giving any explanation which might be necessary. He was charged also to see that his school finished its allotted daily task and dispatched at the close of the session the apparatus in its hands to the next school on the list. In addition to these nine Special Assistants, thirty Head Measurers were employed. The Head Measurers were divided into five sections named after the days of the school week from Monday to Friday. Each section went on its own day to the school whose turn it was to have heads and faces measured. The remaining measurements were made by the teachers.

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* This and the following numbers are the days of the month on which the respective groups of measurements were made.

† Owing to absentees, the number of returns of any one measurement, e. g., height, was less than the number here given.

Not even the industry of these many assistants would have accomplished the task in the required time had there not been an abundance of apparatus. Of measuring-rods, measuring-tapes for the chest, double sets of Snellen-Green test letters, spectacle blinders, watches and callipers, there were a dozen each, and five dynamometers and six small platform-scales were also in constant use. Twelve school rooms could thus often work at the same time, and a great many children were measured in a few hours.

The following printed instructions were given to every measurer.

Form D.

INSTRUCTIONS TO OBSERVERS.

Four printed forms are furnished. These are:

Form A. Male (white paper).
" B. Female (tinted paper).
" C. For parents.
" D. Instructions to observers.

On Monday, January 4th, a sufficient number of these forms will be taken to school A. The same day answers 1, 2, 3, 4, 13, 14 and 32, Form A or B, are written, and each pupil is given Form C to carry home. The next morning form C is returned by the pupils, and answers 5, 6, 7, 8, 9, 10, 11 and 12 are copied on form A or B. The third day the measurements begin, and are carried out according to the following

CALENDAR.

1st day 1, 2, 3, 4, 13, 14, 32.
2d " 5, 6, 7, 8, 9, 10, 11, 12.
3d " 15, 16, 17.
4th " 18, 19.
5th " 20, 21.
6th " 22.
7th " 23, 24.
8th " 25, 26.
9th " 27, 28, 29, 30, 31.

Form C and answers 1 to 12 in forms A and B, require no explanation. The remaining answers are to be sought by the following methods.

Arrange forms A and B in the order in which the pupils sit at their desks, and preserve this arrangement throughout the measurements.

13, 14. Color of Hair and Eyes.

Choose the adjective that most nearly indicates the color; cross out the rest with pen and ink.

15. Height Standing.

1. All the pupils unlace their shoes.

2. The teacher places the measuring rod against the cloak-room door casing, the projections on the rod serving to keep it parallel with the casing, and presumably perpendicular to the floor.

3. The pupil in the first seat comes forward, removes his shoes, stands on a folded newspaper upon which the rod also rests, his heels, body and head touching the door casing, the mouth closed and the chin somewhat depressed. Hair worn in a high knot must be let down.

4. Lower the sliding arm until the edge touches the crown of the pupil's head, and dictate the reading to a pupil assistant, who writes it opposite "15. Height standing." Meanwhile, the second pupil gets ready. [The rods are divided in centimetres and half centimetres; it will be easy to read to quarter centimetres. The dictation should be in the decimal system; thus: "One hundred fifteen, seventy-five (written 115.75), not one hundred fifteen and three quarters.]

5. The first pupil steps to one side, puts on his shoes, returns to his seat, and there laces his shoes. The second pupil removes his shoes and steps on the newspaper. The third pupil comes forward.

16. Height Sitting.

Place an armless wooden chair with a flat seat sideways against the door casing. The measuring rod is held perpendicularly on the seat, the projections on the rod touching if possible the casing. Pupils come forward as before.

Take care: 1, that the lower part of the spinal column touches the rod; 2, that the mouth is closed and the chin somewhat depressed; 3, that hair worn in a knot on the back of the head does not introduce an error. Measure, and dictate the reading.

17. Span of Arms.

1. Draw on the wall a chalk mark parallel with the floor and as high as the chin of a pupil of average height.

2. Hold the measuring rod parallel to the line and as high as the neck of the pupil to be measured.

3. The pupil touches one end with the middle finger of one hand and stretches along the rod as far as he can reach; chin up, heels together, body as close as possible to the rod.

4. Dictate the reading.

[In this and all other measurements the place of the pupil measured should be instantly taken by another.]

18, 19. Strength of Squeeze.

1. Depress the trigger of the dynamometer until the point of the indicator is exactly over the zero line of the scale.

2. The pupil grasps the oval ring in the right hand and squeezes his best.

3. Read the outer scale (graduated from 0 to 160) to pounds[*] as exactly as possible. Write the number after "18. Strength of Squeeze, right hand."

4. Reset the instrument, and test left hand. [Please do not touch the indicator. Always use the trigger.]

20, 21. Girth of Chest.

1. Take four pupils into the cloak room. They remove clothing over chest down to the garment next the skin. The measurements are made *on a level* with the nipples, and are dictated in centimetres and decimal fractions of a centimetre to a pupil assistant, who writes them opposite 20 and 21.

2. "Forced expiration." Pupil breathes out, makes chest as small as possible, inclines head forwards, draws shoulders slightly together.

3. "Forced inspiration." Shoulders back, head raised, deepest possible inspiration.

[Some children will require to be shown how to do this. As fast as a pupil is measured, dresses and returns to his seat, another pupil enters the cloak room to take his place, and strips for measurement.]

22. Weight.

The upper figures on the beam and the smaller of the two numbers on the iron weights are used with the scale pan. Pay no attention to them. The lower figures on the beam read from 1 to 45 pounds. Place the pupil's approximate weight on the counterpoise at the end of the beam; move the poise along the latter until the scale balances. Add the larger number on the hanging weight to the number marked on the lower scale by the poise. The sum is the pupil's weight.

23, 24. Acuteness of Vision.

It is necessary to make these tests between 10:30 a. m., or better 11 a. m., and 3 p. m., as at other hours the winter light is insufficient.

A pupil must not see the card before the moment for his test has come. Nor can the pupils who have been tested be allowed to communicate with those yet to be tested. Otherwise the letters will be committed to memory and the test spoiled.

1. Hang the test card on the wall opposite the windows, in a good light, and level with the pupil's eyes. Turn down the middle leaf of the card, so that only one set of test letters is visible.

2. Stand the pupil with toes touching a chalk mark 16 feet 5 inches from the card, and cover the left eye with the blinder furnished for that purpose. The head must be held straight, so that the child cannot see the test letters with the blinded eye.

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[*] Two dynamometers were graduated metrically.

3. The child reads the test letters beginning with the largest; the smallest letter which can be read indicates the "acuteness of vision" at 16 feet 5 inches (5 metres). Mark the arabic figure under this letter opposite "Acuteness of Vision, right eye."

4. Change the blinder to the right eye.

5. Turn up the middle leaf of the test card so as to expose the second set of test letters.

6. Test the acuteness of vision of the left eye in a similar manner.

25, 26. Acuteness of Hearing.

The hearing tests are to be made in the cloak-room with the doors closed. Their success depends primarily on the absence of all noise from the adjacent class-rooms and halls.

1. The pupil is seated with the right ear towards the observer.

2. An assistant closes the pupil's left ear by pressing the *tragus* (the little cartilage in front of the external opening) inwards with her thumb while with the fingers of the same hand she closes the eyelids with a handkerchief. With the other hand the assistant holds the end of the brass ring of the tape measure against the head just beneath the ear, grasping the ring between thumb and forefinger and keeping the hand entirely below the auditory opening.

3. The observer stands directly opposite the ear and 11 feet from it, holding the tape parallel with the floor. The watch is held by the chain ring against the median line of the observer's body, just above and not touching the tape. The face of the watch is towards the pupil.

4. The observer charges the pupil to say "now" when he hears the watch tick, and advances the watch until the pupil replies. The watch is now withdrawn and again advanced until the pupil replies. Marking this point on the tape measure between finger and thumb, the observer puts the watch behind her back, and asks "Do you hear now?" If the pupil replies "No," the watch is returned to the former position and the inquiry repeated. If the watch is again heard at this distanee the test is satisfactory; if not, it should be repeated. Write the distance at which the watch is heard in feet and inches opposite "Acuteness of Hearing, right ear."

5. Turn the pupil around (180°) and test the left ear in a similar manner.

The wilfulness of some children will make the accuracy of their tests doubtful. In such cases write an interrogation mark after the figures secured.

27, 28, 29, 30. Head Measurements.

The teacher carries the blanks arranged in the order in which the pupils sit in her room, a pen, and a centimetre rule. The medical assistant makes a measurement, places the callipers on the rule which the teacher holds, and reads the number of centimetres and millimetres. The teacher writes these numbers while the assistant makes the next measurement.

Instructions for Medical Assistants.

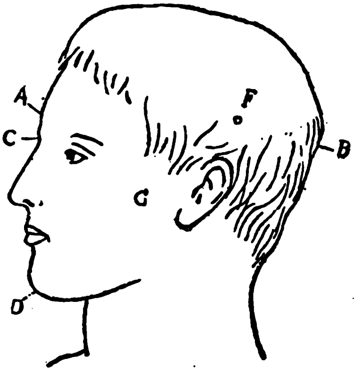
Measurements must be read to millimetres.

1. *Length of head.* — Place one point of the callipers on the most prominent point of the forehead, between the eyebrows. Bring the other point of the callipers down to the posterior part of the head and move it along the middle line until the greatest length of the head is found. (A, B.)

2. *Breadth of head.* — Take the greatest breadth of the head between the ears wherever it is found. Hold the callipers horizontally and perfectly symmetrically, approximately at F.

3. *Height of face.*— Put one point of the callipers in the deepest depression on the nose between the eyes (C)—then press the other point against the chin and find that point at D where the chin turns backwards. Ask the person to press his teeth together.

4. *Breadth of face.*— This is the greatest breadth between the narrow, bony ridges felt in front of the ears. The ridges run from the cheek bones to the ears. Hold the callipers horizontally and symmetrically, approximately at G.



Position of the Points at which Head Measurements are Taken.

A-B, length of head. Approximately at F, breadth of head. C-D, Height of face. Approximately at G, breadth of face.*

5. *Hair line.* — This is the height of face from the point of the chin to the point where the hair begins to grow above the forehead.

Further information, if desired, may be had by addressing the Physiological Laboratory of Washington University, 625 Clark avenue.†

W. Townsend Porter.

Approved Jan. 4th, 1891.
E. H. Long,
Superintendent.

Some changes were made in the above instructions during the course of the investigations. The tests of acuteness of hearing were found impracticable because of the unavoidable noise in the schools and were given up after about seven thousand pupils had been tested. It was noticed that the number possessing less than the normal acuteness of hearing was very large, and more than one pupil was found who had been punished for inattention, the result of an unsuspected deafness. Although the returns did not seem sufficiently trustworthy for statistical treatment, they justified the statement that not a little deafness exists unknown to both teacher and parents. This hidden infirmity deprives the pupil of much of the benefit of class-room instruction.

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* I am indebted to Dr. Franz Boas for this figure.

† Since removed to 1806 Locust street. Dr. Porter's present address is Harvard Medical School, Boston, Mass.

The measurement of the girth of chest over the garment next the skin was also modified after several thousand boys and girls had been measured, and the boys were made to remove coats and vests while the girls were measured over the indoor dress. The few girls who wore stays laid them aside.

CHAPTER II.

THE STATISTICAL METHODS EMPLOYED.

All measurements are accompanied by unavoidable errors. Thus the attempt to measure the height of a man is influenced by the accuracy with which the measuring apparatus is constructed, the care with which it is used, the position of the man's head on the vertebral column, the thickness of the intervertebral disks and a multitude of other factors. Some of these influences would make the observed height greater than the true height, others would make it less. The one group tends to counteract or compensate the other, and the result of their conflict is the measurement actually observed. The observed height therefore is never, except by chance, the real height, but deviates from it in one or the other direction — is now above and now below the truth — as one or the other group of influences gets the upper hand. The greater the number of influences, the more perfectly does compensation take place and the more nearly does the observed result approach the truth. But the truth itself can never be known, for only when the number of influences is infinite, can the probability of perfect compensation between them rise to a certainty. That which we call true is merely the probable truth and is worthy of confidence in exact proportion to its numerical probability.

The influences which affect a measurement are of two sorts, the one accidental and varying, such as, taking the measurement of height for an example, the degree of inclination of the head to the axis of the body, the placing of the measuring-rod and the like, the other constant and unvarying, such as an inaccuracy in the construction of the measuring-rod or a persistent bias in the mind of the observer. In both classes, the degree of compensation varies with the number of influences, for even a constant cause, although not accidental in its nature and found always on one side of the mean, may be compensated by another constant cause on the opposite side of the mean. The accidental or varying influences, however, are much more numerous than the constant or unvarying, and thus compensation is in their case much more complete. Constant, unvarying influences are therefore more deceptive than varying, accidental influences.

In practice, the influences determining the result of a single measurement elude all attempts at calculation, and the extent to which the result of a single observation approximates the truth cannot be told. But if many measurements are made of the same thing, for example the height of a man, the individual measurements arrange themselves on either side of the true height. If only accidental influences have been at work in each individual measurement in the series, the distribution of the observed heights on either side of the real height would, if the number of observations were infinite, be symmetrical. Thus the true height would at once appear, and the probability or degree of deviation of any single measurement would also be visible. Even with finite numbers a probability so great as to amount to a practical certainty can be secured. If 2,000 measurements of the same physical dimension, e. g. the height of an individual, are made carefully, the total number of observations will be distributed nearly as follows: —

TABLE No. 1.

THE DISTRIBUTION OF 2,000 MEASUREMENTS OF THE SAME QUANTITY WHEN THE DEVIATION OF THE INDIVIDUAL OBSERVATIONS FROM THE TRUE VALUE OF THE MEASURED QUANTITY IS DUE TO PURELY ACCIDENTAL CAUSES.*

d = the Probable Deviation.	Number of Observations.
Greater than + 5.0 *d*	1
+ 4.5 *d* to + 5.0 *d*	1
+ 4.0 *d* " + 4.5 *d*	5
+ 3.5 *d* " + 4.0 *d*	11
+ 3.0 *d* " + 3.5 *d*	25
+ 2.5 *d* " + 3.0 *d*	49
+ 2.0 *d* " + 2.5 *d*	85
+ 1.5 *d* " + 2.0 *d*	135
+ 1.0 *d* " + 1.5 *d*	188
+ 0.5 *d* " + 1.0 *d*	236
± .0 " + 0.5 *d*	264
— 0.5 *d* " ± .0	264
— 1.0 *d* " — 0.5 *d*	236
— 1.5 *d* " — 1.0 *d*	188
— 2.0 *d* " — 1.5 *d*	135
— 2.5 *d* " — 2.0 *d*	85
— 3.0 *d* " — 2.5 *d*	49
— 3.5 *d* " — 3.0 *d*	25
— 4.0 *d* " — 3.5 *d*	11
— 4.5 *d* " — 4.0 *d*	5
— 5.0 *d* " — 4.5 *d*	1
Greater than — 5.0 *d*	1

This result is quite independent of the nature of the thing measured, provided that no unvarying influences are at work.

An examination of Table No. 1 shows (1) that the distribution of the observations is symmetrical about a median point, in other words that equal deviations to one and the other side of this point are equally probable; (2) that half the whole number of observations fall within ± 1.0 *d* of the most probable value, indicating that a small deviation is more probable than a large one; and (3) that there is a limit beyond which no deviation occurs. Such are the peculiarities of a series of observations in which the deviations from the true value are due to purely accidental causes. It is evident that the most probable value of the true measurement is typical of the whole series, and that the degree of probability of any deviation from the type is easily calculated; for example in the series of Table No. 1, the chances are even that any deviation will fall between +1.0 *d* and—1.0 *d*, for it has been seen that half the whole number of observations fall within these limits.

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* After Thoma: Untersuchungen über die Grösse der anatomischen Bestandtheile des menschlichen Körpers im gesunden und kranken Zustande. Leipzig, 1882. Page 28.

Quetelet demonstrated that the method of grouping related measurements could be used not only for showing the most probable height of one individual but also for showing the most probable or typical height, i. e., that most often found, of a number of individuals. The Belgian Astronomer Royal pointed out that the series obtained by measuring a number of individuals of the same type, e. g., men of the same nationality, was characterized by the peculiarities that distinguish a series in which the deviations from the typical or most probable value are due to accidental causes. The truth of this statement is obvious when the two are compared.

TABLE No. 2.*

HEIGHTS OF UNITED STATES RECRUITS.

Height at Intervals of One Inch.	Number of Recruits.
Between 78 and 79 inches	2
" 77 " 78 "	6
" 76 " 77 "	9
" 75 " 76 "	42
" 74 " 75 "	118
" 73 " 74 "	348
" 72 " 73 "	680
" 71 " 72 "	1485
" 70 " 71 "	2075
" 69 " 70 "	3133
" 68 " 69 "	3631
" 67 " 68 "	4054
" 66 " 67 "	3475
" 65 " 66 "	3019
" 64 " 65 "	1947
" 63 " 64 "	1237
" 62 " 63 "	526
" 61 " 62 "	50
" 60 " 61 "	15
" 59 " 60 "	10
" 58 " 59 "	6
" 57 " 58 "	7
" 56 " 57 "	3
" 55 " 56 "	1
" 55 and less	4
	Total...25878

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* E. B. Elliott's table in Medical Statistics of the Provost-Marshal-General's Bureau, by J. H. Baxter, 1875, Vol. I. Introduction, page lxxx.

If the individual heights of a group of adults are found to be approximations of a middle, typical height, it would seem that the heights of children of the same sex, age and class must show a similar relation to a type; and this inference is justified by observation.

TABLE No. 3.

OBSERVED DISTRIBUTION OF THE HEIGHTS OF 2192 ST. LOUIS SCHOOL GIRLS, AGED 8.

Heights at Intervals of 2 Centimetres.	Number of Observations.
141 and 142 cm.	1
139 " 140 "	
137 " 138 "	1
135 " 136 "	5
133 " 134 "	10
131 " 132 "	21
129 " 130 "	28
127 " 128 "	79
125 " 126 "	138
123 " 124 "	183
121 " 122 "	243
119 " 120 "	342
117 " 118 "	321
115 " 116 "	297
113 " 114 "	222
111 " 112 "	137
109 " 110 "	84
107 " 108 "	42
105 " 106 "	27
103 " 104 "	8
101 " 102 "	2
99 " 100 "	1
Total	2192

The characteristics of a series in which the individual observations are accidental deviations from a typical middle value are established by methods which have long been used by astronomers and mathematicians. These methods seek to determine (1) the middle or typical value and (2) the way in which the individual observations are dispersed on either side of this value. Some statisticians take the average to be the nearest approach to the typical value, others prefer the mean, i. e., median value.* It will be necessary to consider at some length the relative value of average and mean in anthropometrical studies of the growth of children, but for the present a

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* Throughout this work the word MEAN is used as the synonym of MEDIAN VALUE, and not in the sense of ARITHMETICAL MEAN, which is called here the AVERAGE. The MIDDLE VALUE will be employed as meaning either Median or Average value.

statement of the methods by which the mean and average are secured will suffice.

By AVERAGE (A) is meant the quotient obtained by dividing the sum (Σa) of the values (a) obtained in the individual measurements by the whole number of measurements (n).

$$A = \frac{\Sigma a}{n} \qquad (1)$$

The calculation of the average height of girls, aged 9, will serve as an example.

TABLE No. 4.

THE CALCULATION OF THE AVERAGE HEIGHT OF ST. LOUIS SCHOOL GIRLS, AGED 9.

Height in Centimetres.	Number of Observations. (n)	Product. (a)	Height in Centimetres.	Number of Observations. (n)	Product. (a)
168	1	168	134	25	3350
167			133	31	4123
166			132	29	3828
165			131	62	8122
164			130	78	10140
163			129	91	11739
162			128	119	15232
161			127	132	16764
160	1	160	126	143	18018
159			125	162	20250
158			124	141	17484
157			123	162	19926
156			122	145	17690
155			121	130	15730
154			120	145	17400
153			119	97	11543
152			118	94	11092
151			117	69	8073
150			116	59	6844
149			115	47	5405
148			114	30	3420
147			113	18	2034
146			112	11	1232
145			111	10	1110
144			110	10	1100
143	1	143	109	5	545
142	2	284	108	1	108
141	3	423	107	5	535
140	2	280	106	3	318
139	3	417	105	1	105
138	9	1242	104	1	104
137	12	1644	103	1	103
136	15	2040	102		
135	14	1890	101		
			100	2	200
			Total.....	$n = 2122$	$\Sigma a = 262358$

$$A = \frac{\Sigma a}{n} = \frac{262358}{2122} = 123.64 \text{ cm.}$$

If the number of observations is very large, the MEAN (MEDIAN value, *M*,) may be found with considerable accuracy by a mere inspection of the series. The mean of such a series is the measurement which most frequently recurs. Thus, the mean height of the recruits of Table No. 2, page 278, is between 67 and 68 inches. The accuracy with which the mean can thus be found depends not only on the number of observations, but also on the size of the units of measurement.

For most purposes it is desirable to know not merely at which inch, centimetre, kilogramme or other unit the greatest number of observations is found, but exactly at what fraction of the unit. Again, the relation between the number of observations and the size of the unit may be such that the largest number of observations at one unit will not fall at the true mean, or line dividing the total number of observations into two equal groups. The method by which the mean can be calculated with exactness will be illustrated by the following example. The mean height of the girls in Table No. 4 is obtained by adding the number of observations from below upwards until the sum cannot be increased by the next number in the column without exceeding half of the total number of observations. Thus 1046 is reached opposite 123 cm.; the next number in the column (141) would make the sum 1187, which is more than the half (1061) of the total number of observations (2122). The mean is, therefore, greater than 123 cm. but less than 125 cm. Its position is found by interpolation. Half of the total number of observations is 1061, which is 15 more than the sum of the observations up to 124 cm.; 15 is 11 per cent. of 141, the observations at 124 cm. Hence, the mean is 124.15 cm.

Neither the mean nor the average can give any information as to the way in which the individual observations in a series are distributed, and it is plain that two series having an identical mean or average may differ greatly in respect of the dispersion of the individuals from the middle value. Thus the two very different series —

4, 5, 6, 14, 15, 16
9, 9, 10, 10, 11, 11

have the same average (10). The best measure of the degree of dispersion or deviation of the individual members of a series from their common mean or average is that afforded by the Probable Deviation. The probable deviation is that deviation from the middle value, which, in a large series of observations, is as often exceeded as attained (Lexis). In other words, half of the whole number of observations fall short of the probable deviation, while the other half exceed it. A deviation which exceeds is as probable as one that does not reach this value. The probable deviation can be calculated with the formula —

$$d = \pm\ 0.6745\sqrt{\frac{\Sigma\,\delta^2}{n-1}} \qquad (2)$$

In this formula:

d = the probable deviation.
$\Sigma\delta^2$ = the sum of the squares of the individual deviations from the mean or average.
n = the number of observations in the series.

In the place of this formula, in which the calculation of $\Sigma\delta^2$ requires much labor when the number of observations is great, a simpler formula may be safely used in getting the deviation in a large series.

$$d = \pm\ 0.8453\,\frac{\Sigma\,\delta}{n} \qquad (3)$$

The formula says that all the individual deviations from the mean or average of a series must be added together without regard to whether they are plus or minus and divided by the total number of observations. The working of the formula will be illustrated by finding the probable deviation from the average height of girls aged 8.

TABLE No. 5.

THE CALCULATION OF THE PROBABLE DEVIATION (*d*) FROM THE AVERAGE HEIGHT (118.36 CM.) OF 2193 GIRLS, AGED 8.

Height at Intervals of 2 Centimetres.	Σ	δ	Σ δ
141 and 142 Cm.	1	23.64	23.64
139 “ 140 “			
137 “ 138 “	1	19.64	19.64
135 “ 136 “	5	17.64	88.20
133 “ 134 “	10	15.64	156.40
131 “ 132 “	21	13.64	286.44
129 “ 130 “	28	11.64	325.92
127 “ 128 “	79	9.64	761.56
125 “ 126 “	138	7.64	1054.32
123 “ 124 “	183	5.64	1032.12
121 “ 122 “	243	3.64	884.52
119 “ 120 “	342	1.64	560.88
117 “ 118 “	321	0.36	115.56
115 “ 116 “	297	2.36	700.92
113 “ 114 “	222	4.36	967.92
111 “ 112 “	137	6.36	872.69
109 “ 110 “	84	8.36	702.24
107 “ 108 “	42	10.36	435.12
105 “ 106 “	27	12.36	333.72
103 “ 104 “	8	14.36	114.88
101 “ 102 “	2	16.36	32.72
99 “ 100 “	1	18.36	18.36
Total......	2192		9487.77

$$d = \pm\ 0.8453 \frac{9487.77}{2192} = \pm\ 3.698 \text{ Cm.}$$

The distribution of the above series of the heights of girls, aged 8, is therefore characterized by a probable deviation of ± 3.7 cm.; that is, one against one may be wagered that no girl aged 8 will be taller than 122.06 cm. or shorter than 114.66 cm. If the number of observations falling between A ± *d*, A ± 2*d*, A ± 3*d*......A ± ^{n}d be noted, a complete picture of the individual observations in a series will be obtained. This observed distribution may then be compared directly with the distribution of the observations in an hypothetical series constructed according to the calculus of probabilities. The observed and the theoretical series should correspond, if the causes of deviation are purely accidental. It has already been said that such a comparison must be made before it can be known whether the observations in any series can be treated by the methods of the theory of probabilities. It is however not necessary to compare more than one of a number of series in which the distribution follows a common type. It will suffice for our purposes therefore to compare the distribution of the 2192 heights in Table No. 3, page 279, with the distribution of an equal number according to the calculus of probabilities. The method by which this is done permits the construction of a curve from the observations actually made which shall be the probable form of a curve representing the distribution of the entire class from which the observations have been drawn.

The number of observation (Z) which should be included between the average (A) and any deviation from the average, in other words any multiple (*m*) of the probable deviation (*d*), is obtained from the equation.*

$$P = \frac{2}{\sqrt{\pi}} \int_{0}^{t} e^{-t^2} dt \qquad (4)$$

The labor of calculating deviations with the aid of this equation is avoided by the use of such tables as Stieda's, reproduced below.

TABLE No. 6.

Stieda's Table for Calculating the Number of Observations at any Distance from the Mean or Average within the Limits: M+5*d* and M—5*d*.

p	Percent.	*p*	Percent.
0.1	5.4	1.8	77.5
0.2	10.7	1.9	80.0
0.3	16.0	2.0	82.3
0.4	21.3	2.1	84.3
0.5	26.4	2.2	86.2
0.6	31.4	2.3	87.9
0.7	36.3	2.4	89.5
0.8	41.1	2.5	90.8
0.9	45.6	2.6	92.1
1.0	50.0	2.7	93.1
1.1	54.2	2.8	94.1
1.2	58.2	2.9	95.0
1.3	61.9	3.0	95.7
1.4	65.5	3.5	98.2
1.5	68.8	4.0	99.3
1.6	71.9	4.5	99.8
1.7	74.8	5.0	99.93

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* Kramp. L'Analyse des réfractions astronomiques.

If p is allowed to represent one of the figures in the first column and A the average of all the measurements in a series, the figures opposite p in the second column will give the per cent. of individual measurements lying within the limits:

$$A + p \cdot d \text{ and } A - p \cdot d$$

Suppose for example it were required to know how many of a series of 2192 girls aged 8 were of a height between the average (118.36 cm.) and a deviation of ± 1.5 *d* (1.5. 3.7 cm. = 5.55 cm.), i. e. between 118.36 cm. + 5.55 cm. = 123.91 cm. and 118.36 cm. — 5.55 cm. = 112.81 cm. The number in the table opposite 1.5 is 68.8, which says that 68.8 per cent. of the 2192, or 1508, should fall within the limits stated. Then half this number must fall between A and A + 1.5 *d* (118.36 cm. and 123.91 cm.). In a similar manner it will be found that 50 per cent. of the whole number, or 1096, should fall within the limits A ± d (118.36 cm. + 3.7 cm. = 122.06 cm. and 118.36 cm. — 3.7 cm. = 116.51 cm.), and 25 per cent. between A and A + *d* (118.36 cm. and 122.06 cm.). Thus may be calculated the number of observations which should occur at any deviation from the average. The theoretical and observed distribution of 2192 girls, aged 8, is compared in Table No. 7.

TABLE No. 7.

THE THEORETICAL AND THE OBSERVED DISTRIBUTION OF THE HEIGHTS OF 2192 GIRLS, AGED 8.

Probable Deviation *d.*	Heights at Intervals of of ± 0.5*d.*	Theoretical Distribution.	Observed Distribution.
+ 5.0 *d*	136.86 Cm.	2	2
+ 4.5 "	135.01 "	6	8
+ 4.0 "	133.26 "	12	18
+ 3.5 "	131.31 "	27	27
+ 3.0 "	129.46 "	54	57
+ 2.5 "	127.61 "	93	104
+ 2.0 "	125.76 "	148	150
+ 1.5 "	123.91 "	206	209
+ 1.0 "	122.06 "	259	286
+ 0.5 "	120.21 "	289	300
0.0 "	118.36 "		
— 0.5 "	116.51 "	289	272
— 1.0 "	114.66 "	259	275
— 1.5 "	112.81 "	206	196
— 2.0 "	110.96 "	148	126
— 2.5 "	109.11 "	93	80
— 3.0 "	107.26 "	54	40
— 3.5 "	105.41 "	27	26
— 4.0 "	103.56 "	12	12
— 4.5 "	101.71 "	6	3
— 5.0 "	99.86 "	2	2
	Total......	2192	2192

The curves in Plate I[*] give a graphic representation of the figures in Table No. 7. A glance at these curves shows that there is a close agreement between them, indicating that the individual observations out of which they are constructed are symmetrically grouped about a middle value typical of the whole, and proving that the material with which we have to deal satisfies the requirements of theory.

The method of showing distribution just described is not the only method used for this purpose. Francis Galton[†] determines the actual distribution of the observations in a series at intervals of 5 or 10 per cent. from the median or 50 "percentile grade." The calculation of the median value (mean) or 50 percentile grade has already been described: that for the 5, 10, 20 and other percentile grades is similar in principle. The percentile grades of the heights of girls, aged 9, are as follows: —

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[*] The plates are placed after the index at the end of the number.

[†] Natural Inheritance. London, 1889.

TABLE No. 8.

THE PERCENTILE DISTRIBUTION OF THE HEIGHTS OF GIRLS, AGED 9.

Percentile Grades.	Number of Observations.	Heights.
95	2015.9	133.42 Cm.
90	1909.8	130.97 "
80	1697.6	128.62 "
75	1591.5	127.58 "
70	1485.4	126.54 "
60	1273.2	125.53 "
50	1061.0	124.11 "
40	848.8	122.76 "
30	636.6	121.21 "
25	530.5	120.90 "
20	424.4	119.59 "
10	212.2	117.12 "
5	106.1	115.17 "
Total............	2122	

The Probable Error of the Average can be determined by means of the formula

$$E = \pm \frac{d}{\sqrt{n}} \qquad (5)^*$$

where E = the probable error of the average,
d = the probable deviation of an individual from the average,
n = the number of observations in the series.

Substituting the values determined for the heights of girls, aged 9, we have —

$$E = \pm \frac{3.698}{\sqrt{2122}} = \pm 0.079 \text{ cm.}$$

The values of E are given in Table No. 9.

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* Formulas (1), (2), (3) and (5) and Table No. 6 are taken from L. Stieda's admirable article: Ueber die Anwendung der Wahrscheinlichkeitsrechnung in der anthropologischen Statistik. Archiv. für Anthropologie, Bd. xiv., 1882, p. 167-182.

TABLE No. 9.

THE PROBABLE ERROR OF THE AVERAGE: $E = \pm \frac{d}{\sqrt{n}}$, where e = Probable Error,
d = Probable Deviation,
n = Number of Observations.

mensions.	Sex.	Unit of Measurement.	Age at Nearest Birthday, and Probable Error.															
			6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
			±	±	±	±	±	±	±	±	±	±	±	±	±	±	±	±
Weight, in Indoor Dress.	**Boys.**	Kilogramme	**0.054**	**0.039**	**0.042**	**0.045**	**0.049**	**0.062**	**0.061**	**0.110**	**0.148**	**0.227**	**0.481**	**0.521**				
	Girls.		0.051	0.045	0.042	0.049	0.052	0.070	0.081	0.115	0.142	0.154	0.207	0.244	0.289	0.332	0.565	
Height Standing, Without Shoes.	**Boys.**	Centimetre..	**0.128**	**0.084**	**0.082**	**0.080**	**0.087**	**0.099**	**0.116**	**0.140**	**0.183**	**0.286**	**0.427**	**0.592**	**0.924**			
	Girls.		0.123	0.089	0.079	0.083	0.089	0.106	0.098	0.150	0.156	0.151	0.197	0.241	0.265	0.438	0.353	0.651
Height Sitting......	**Boys.**	Centimetre..	**0.105**	**0.061**	**0.048**	**0.049**	**0.058**	**0.060**	**0.067**	**0.076**	**0.108**	**0.161**	**0.250**	**0.427**	**0.536**			
	Girls.		0.132	0.053	0.044	0.046	0.049	0.057	0.063	0.078	0.095	0.098	0.116	0.153	0.133	0.198	0.230	0.290
Span of Arms.......	**Boys.**	Centimetre..	**0.144**	**0.096**	**0.088**	**0.089**	**0.108**	**0.118**	**0.112**	**0.159**	**0.197**	**0.321**	**0.574**	**0.581**	**0.761**			
	Girls.		0.140	0.107	0.092	0.092	0.104	0.116	0.109	0.150	0.160	0.176	0.217	0.285	0.334	0.517	0.474	0.712
Girth of Chest, Inspiration.	**Boys.**	Centimetre..	**0.083**	**0.057**	**0.051**	**0.053**	**0.059**	**0.065**	**0.072**	**0.089**	**0.116**	**0.172**	**0.305**	**0.332**	**0.551**			
	Girls.		0.087	0.061	0.053	0.056	0.060	0.072	0.078	0.097	0.113	0.137	0.152	0.217	0.243	0.340	0.331	0.482
Girth of Chest, Expiration.	**Boys.**	Centimetre..	**0.083**	**0.057**	**0.052**	**0.056**	**0.068**	**0.061**	**0.076**	**0.088**	**0.119**	**0.165**	**0.281**	**0.374**	**0.504**			
	Girls.		0.094	0.062	0.053	0.058	0.062	0.078	0.083	0.098	0.115	0.148	0.175	0.248	0.265	0.420	0.347	0.560
Strength of Squeeze, Right Hand.......	**Boys.**	Kilogramme	**0.056**	**0.039**	**0.045**	**0.055**	**0.061**	**0.068**	**0.082**	**0.126**	**0.143**	**0.244**	**0.414**	**0.458**				
	Girls.		0.053	0.043	0.043	0.049	0.053	0.060	0.072	0.093	0.133	0.147	0.200					
Strength of Squeeze, Left Hand........	**Boys.**	Kilogramme	**0.057**	**0.044**	**0.048**	**0.059**	**0.059**	**0.067**	**0.080**	**0.108**	**0.134**	**0.248**	**0.488**	**0.639**				
	Girls.		0.056	0.042	0.046	0.049	0.053	0.059	0.076	0.094	0.127	0.154	0.207	0.264				
Length of Head.....	**Boys.**	Millimetre..	**0.171**	**0.118**	**0.106**	**0.109**	**0.094**	**0.129**	**0.115**	**0.181**	**0.182**	**0.208**	**0.355**	**0.575**	**0.717**			
	Girls.		0.170	0.108	0.092	0.101	0.102	0.119	0.114	0.132	0.143	0.180	0.256	0.275	0.252	0.466	0.438	
Width of Head......	**Boys.**	Millimetre..	**0.118**	**0.090**	**0.082**	**0.084**	**0.090**	**0.095**	**0.092**	**0.114**	**0.129**	**0.186**	**0.249**	**0.486**	**0.685**			
	Girls.		0.154	0.099	0.082	0.083	0.093	0.097	0.105	0.115	0.130	0.150	0.210	0.242	0.300	0.466	0.426	
Root of Nose to Point of Chin.	**Boys.**	Millimetre..	**0.207**	**0.120**	**0.103**	**0.107**	**0.110**	**0.127**	**0.132**	**0.160**	**0.174**	**0.238**	**0.346**	**0.744**	**0.888**			
	Girls.		0.194	0.115	0.099	0.103	0.109	0.116	0.129	0.133	0.156	0.192	0.245	0.345	0.297	0.421	0.469	0.627
Width of Face......	**Boys.**	Millimetre..	**0.172**	**0.101**	**0.090**	**0.101**	**0.092**	**0.108**	**0.118**	**0.122**	**0.158**	**0.196**	**0.360**	**0.527**	**0.718**			
	Girls.		0.174	0.101	0.087	0.092	0.127	0.107	0.109	0.127	0.135	0.157	0.201	0.275	0.265	0.420	0.419	0.528
Hair Line to Point of Chin.	**Boys.**	Millimetre..	**0.209**	**0.159**	**0.122**	**0.127**	**0.127**	**0.148**	**0.187**	**0.178**	**0.236**	**0.292**	**6.425**	**0.358**	**0.189**			
	Girls.		0.238	0.187	0.119	0.121	0.131	0.143	0.148	0.178	0.193	0.211	0.286	0.437	0.520	0.749	0.560	0.786

The mean or average of the observations at any age in the period of growth is typical of the child at that age, and a comparison of the means at different ages will reveal the law of growth of the type. Again, the mean of the observations at any deviation from the mean of the whole number, for example the height at a deviation of $+ d$ from the mean, or, if Galton's method is employed, the height at any percentile grade, is the type of those who stand at a certain degree of deviation from the type of the whole number. Thus types of tall and short, light and heavy children are secured. The types of the same degree of deviation from the mean at all ages are as comparable as the type of the whole number of observations, and reveal the growth of the typically tall and short, light and heavy children; but the comparison is less secure the greater the deviation from the mean, for the probable error is inversely as the square of the number of observations, and the number of observations rapidly diminishes on either side of the mean.

The methods described in this chapter have been employed in the present investigation. For every entire series here presented, the mean and the average, the probable deviation and the probable error, and the 5, 10, 20, 25, 30, 40, 50, 60, 70, 75, 80, 90 and 95 percentile grades have been calculated. The 25 and 75 percentile grades were obtained by dividing by 2 the sums of the 20 and 30, and the 70 and 80 percentile grades respectively.

CHAPTER III.

TRUSTWORTHINESS OF THE MATERIAL; ITS LIMITATIONS. COMPARISON OF MEDIAN AND AVERAGE VALUES.

The question first to be decided in the discussion of an anthropometrical series is whether the individual observations are so related one to another that they constitute accidental deviations from a middle value. The method of answering this question by comparing the series of observations with a series constructed according to the theory of probabilities has already been described, and it has been stated incidentally that the heights of St. Louis girls aged 8 agreed with the theoretical series in their distribution. Where such an agreement exists, the individual observations are to be regarded as approximations of a middle value which is the type of the series. It is not necessary to make this comparison at more than one age, or in more than one dimension, for it is known that if one series in a group like that with which we have to deal shows this agreement the other series will be found to do the same. In the present case, additional evidence of the correspondence between observation and theory could be furnished, were it required, by Table No. 10, containing the probable deviation

TABLE No. 10.

THE PROBABLE DEVIATION (d) FROM THE AVERAGE: $d = \pm\ 0.8453.\ \frac{\Sigma\delta}{n}$, where

δ = Deviation from Average.
$\Sigma\delta$ = Sum of Individual Deviations.
n = Total Number of Observations.

Dimensions.	Sex.	Unit of Measurement.	Age at Nearest Birthday and Probable Deviation.															
			6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
			±	±	±	±	±	±	±	±	±	±	±	±	±	±	±	±
Weight	Boys.	Kilogramme	1.43	1.68	1.96	2.09	2.23	2.60	2.46	3.88	4.56	5.06	6.16	4.38				
	Girls.		1.44	1.88	1.95	2.23	2.31	2.91	3.31	4.22	4.67	4.05	4.24	3.70	3.60	3.76	3.76	
Height Standing	Boys.	Centimetre	3.40	3.61	3.89	3.75	3.98	4.23	4.47	4.98	5.58	6.33	5.87	5.15	4.98			
	Girls.		3.42	3.75	3.70	3.83	4 06	4.48	5.23	5.46	5.15	4.01	4.05	3.45	3.39	4.04	3.08	4.27
Height Sitting	Boys.	Centimetre	2.82	2.64	2.26	2.34	2.42	2.56	2.72	2.74	3.15	3.59	3.48	3.77	2.89			
	Girls.		2.03	2.19	2.04	2.11	2.19	2.37	2.61	2.87	3 11	2.54	2.36	2.17	1.72	1.82	2.03	1.86
Span of Arms	Boys.	Centimetre	3.85	4.16	4.18	4.25	4.70	4.84	4.57	5.71	6.03	7.15	7.89	5.03	4.31			
	Girls.		3.87	4.18	4.28	4.18	4.69	4.87	4.51	5.55	5.29	4.58	4.41	4.05	4.28	4.71	4.13	4.33
Girth of Chest, Full Inspiration.	Boys.	Centimetre	2.28	2.39	2.34	2.42	2.68	2.70	2.86	3.13	3.51	3.84	4.37	2.95	3.07			
	Girls.		2.38	2.43	2.40	2.50	2.62	2.91	3.14	3.51	3.62	3.53	3.03	3.15	3.11	3.08	2.67	2.78
Girth of Chest Full Expiration.	Boys.	Centimetre	2.15	2.37	2.36	2.60	2.80	2.52	3.01	3.08	3.64	3.69	4.01	3.85	2.81			
	Girls.		2.57	2.51	2.40	2.56	2.71	3.18	3.33	3.56	3.67	3.80	3.51	3.52	3.35	3.78	2.84	2.91
Strength of Squeeze, Right Hand	Boys.	Kilogramme	1.41	1.52	1.95	2.45	2.66	2.74	3.17	4.27	4.15	5.10	5.29					
	Girls.		1.39	1.67	1.87	2.11	2.27	2.42	2.83	3.31	4.11	3.65	3.77					
Strength of Squeeze, Left Hand	Boys.	Kilogramme	1.43	1.72	2.08	2.66	2.57	2.70	3.11	3.50	3.93	5.10	5.58	4.87				
	Girls.		1.47	1.62	2.00	2.10	2.23	2.36	2.98	3.35	3.90	3.84	3.93	3.17				
Length of Head	Boys.	Millimetre	4.21	4.57	4.85	4.87	4.13	5.26	4.56	4.55	5.44	4.66	4.98	5.08	4.18			
	Girls.		4.20	4.22	4.26	4.39	4.33	4.70	4.46	4.55	4.53	4.58	5.12	4.09	3.20	4.09	3.75	
Width of Head	Boys.	Millimetre	2.82	3.58	3.68	3.74	3.85	3.76	3.61	3.90	3.82	4.03	3.48	4.21	3.88			
	Girls.		3.81	3.86	3.66	3.65	3.96	3.80	4.03	3.92	3.96	3.84	4.17	3.60	3.85	4.14	3.64	
Root of Nose to Point of Chin	Boys.	Millimetre	5.09	4.80	4.67	4.82	4.77	5.18	5.22	5.54	5.21	5.21	4.79	6.57	4.92			
	Girls.		4.80	4.45	4.46	4.48	4.64	4.61	5.05	4.68	4.94	4.98	4.91	5.15	3.79	3.77	4.01	3.66
Width of Face	Boys.	Millimetre	4.24	4.09	4.08	4.44	4.05	4.52	4.42	4.27	4.56	4.38	5.01	4.69	4.18			
	Girls.		4.30	3.92	3.97	4.02	4.38	4.17	4.26	4.45	4.26	4.08	4.07	4.08	3.38	3.76	3.58	3.08
Hair Line to Point of Chin.	Boys.	Millimetre	5.18	6.40	5.46	5.67	5.55	5.80	5.44	6.01	7.05	6.41	5.90	7.60	8.00			
	Girls.		5.88	5.28	5.27	5.38	5.62	5.70	5.76	6.04	6.11	5.40	5.69	6.20	6.13	6.22	4.76	4.52

from the average. It is seen in this table that the probable deviations are small, that is, one-half of the observations deviate but little from the middle value, which is one of the fundamental attributes of deviations due to accidental causes. But additional evidence is hardly required, and few critics will object to regarding the middle values in this investigation as types of their respective series.

The objection sometimes made that the errors of observation materially affect the truth of the values obtained is of little weight, partly because such errors are "accidental" and compensate each other as already explained, and partly because a deviation from the middle value due to an uncompensated error in measurement forms, as a rule, an inconsiderable part of that greater deviation which expresses the physiological difference between the individual and the type of his age and class. Accidental errors of observation need not give concern in measurements of great numbers of school children. Nor need there be much fear of constant errors of observation, provided the collection of material is made by many persons and with a good number of each sort of measuring instrument. If hundreds of teachers take part in the measurements, as in the present investigation, a constant cause of error due to a teacher's unconscious bias or personal equation on one side of the middle value will very probably be compensated by the bias of another teacher on the opposite side, and, similarly, if a number of scales are used, the errors of those which weigh too lightly are likely to be compensated by the errors of those whose readings are too heavy.

The trustworthiness of this material must be encouraging to those whose hold on the theory underlying these matters is not very strong, because it illustrates the truth that the types of physical development, and the laws of growth of the type may be induced from measurements made by comparatively unskilled hands and demonstrates that a system of anthropometrical measurements may be fruitfully employed in the public schools.

The use to which middle values and the deviations from middle values shall be put is in part the subject of controversy, and it will be well to state here the manner in which they shall be employed in the present work. In doing so it will be necessary to give a brief account of the matters concerning which agreement is general as well as those which are in dispute.

It is acknowledged generally that the method of Quetelet furnishes a middle value typical of the series from which it was drawn, for example the middle weight of boys of the same age, nationality and social condition is the typical weight of boys of that age and class; and it is further acknowledged that the increase in the middle value from year to year expresses the law of growth of the type. It follows that the middle value of those who stand at any deviation from the middle value of the whole number is the type of that degree of deviation from the type of the whole number and that the increase in the middle value at the same degree of deviation at each age in the period of growth expresses the law of growth of the type at that degree of deviation. Thus the curves of percentile grades printed below express the growth of the typical St. Louis school-boy and girl. The type at a certain deviation from the mean of an age will show the same degree of deviation from the mean at any subsequent age; for example a type-boy in the 75 percentile grade at age 6 will throughout his growth be heavier than 75 per cent. of boys of his own age. Percentile curves are of course not necessarily parallel. The type of the 50 per cent. who exceed the middle value of the whole number has a law of growth characteristic of tall boys and different from that of the type of the 50 per cent. who fall below the middle value of the whole number.

The application of the middle value to individuals has not yet been mentioned. It is here that controversy finds its hold. The relation of the individual to the type is not known. It is not known whether a boy who at age 6 is heavier than 75 per cent. of boys at his age will at age 18 be heavier than 75 per cent. of boys at that age. Some anthropologists believe that there is at least probability that children remain in the same percentile grade throughout life, while others dissent from this view. In truth the development of the individual has been little studied, and it is therefore not yet possible to state his probable future growth.

This question — the relation of the growth of the individual to the growth of the type — can be determined only by the individualizing method. The generalizing method deals solely with units, irrespective of their individuality. If for example John Smith in the 75 percentile grade and William Harrison in the 60 percentile grade at age 6 exchange places at age 7, the personal curve of each boy undergoes an important deviation, but the number of units in the two grades, and consequently the middle value in each, is unaltered. The generalizing method, therefore, furnishes no data by which the future development of individuals can be safely judged. The individualizing method, on the contrary, follows the individual from year to year throughout his growth and establishes the frequency and extent of his deviations from the growth of the type. The lack of data collected by the individualizing method is regrettable, but this gap in our knowledge does not prevent the establishing of physical standards by which the probability that the physique of any child is normal or abnormal can be fixed.

The facts stated above limit the application of middle values to (1) the establishing of physical standards at each age, and (2) the using of these standards to determine whether the physique of any child is normal: they do not, in the present state of knowledge, permit prediction of future growth.

It has been much disputed whether the median value or the average should be taken for the type. Many investigators agree with Sir John Herschel, who declares in his celebrated review of Quetelet's *Lettres sur la théorie des probabilités* (page 23) that an average "may be convenient, to convey a "general notion of the things averaged, but involves no con-"ception of a natural and recognizable central magnitude all "differences from which ought to be regarded as deviations "from a standard. The notion of a mean, on the other "hand, does imply such a conception, standing distinguished "from an average by this very feature, viz.: the regular "march of the groups, increasing to a maximum, and thence "again diminishing. An average gives us no assurance that "the future will be like the past. A mean may be reckoned "on with the most implicit confidence. All the phil-

" osophical value of statistical results depends on a due " appreciation of this distinction and acceptance of its " consequences."

Other statisticians have used the average exclusively. Out of respect to this difference of opinion, both the median value and the average have been employed in the present work. On calculating these values for each series, it was found that the difference between them was inconsiderable, showing that

TABLE No. 11.

MEDIAN MINUS AVERAGE VALUES.

Dimensions.	Sex.	Unit of Measurement.	Age at Nearest Birthday, and Median Minus Average Values 6	7	8	9	10	11	12
Weight	**Boys.**	Kilogramme	**+0.10**	**—0.01**	**+0.09**	**+0.16**	**+0.04**	**+0.08**	**—0.1**
	Girls.		+0.06	—0.01	—0.03	—0.04	—0.04	—0.35	—0.4
Height Standing	**Boys.**	Centimetre	**+0.29**	**+0.45**	**+0.64**	**+0.52**	**+0.68**	**+0.60**	**+0.3**
	Girls.		+0.43	+0.49	+0.38	+0.44	+0.42	+0.41	+0.4
Height Sitting	**Boys.**	Centimetre	**—0.54**	**—0.10**	**+0.47**	**+0.35**	**—0.40**	**+0.42**	**+0.1**
	Girls.		+0.66	+0.64	+0.99	+0.03	+0.69	+0.59	+0.5
Span of Arms	**Boys.**	Centimetre	**+0.62**	**+0.66**	**+0.66**	**+0.49**	**+0.39**	**+0.46**	**—0.1**
	Girls.		+0.33	+0.75	—0.20	+0.65	+0.43	+0.22	+0.5
Girth of Chest, Inspiration.	**Boys.**	Centimetre	**+0.20**	**+0.30**	**+0.17**	**+0.49**	**+0.44**	**+0.47**	**+0.4**
	Girls.		+0.58	+0.28	+0.57	+0.56	+0.49	+0.55	+0.1
Girth of Chest, Expiration.	**Boys.**	Centimetre	**+0.34**	**+0.24**	**+0.56**	**+0.37**	**+0.22**	**+0.40**	**+0.4**
	Girls.		+0.48	+0.51	+0.48	+0.48	+0.40	+0.48	+0.1
Strength of Squeeze, Right Hand	**Boys.**	Kilogramme	**+0.21**	**—0.02**	**+0.21**	**—0.70**	**—0.11**	**—0.08**	**—0.1**
	Girls.		+0.79	+0.03	+0.13	—0.09	—0.06	+0.27	—0.0
Strength of Squeeze, Left Hand	**Boys.**	Kilogramme	**+0.53**	**—0.04**	**—0.02**	**—0.19**	**—0.13**	**—0.23**	**—0.2**
	Girls.		+0.69	+0.54	—0.22	—0.18	—0.59	+0.02	+0.0
Length of Head	**Boys.**	Millimetre	**+0.47**	**+0.38**	**+0.82**	**+0.28**	**+0.06**	**+0.49**	**+0.2**
	Girls.		+0.89	+0.49	+1.23	+1.41	+1.28	+1.67	+1.0
Width of Head	**Boys.**	Millimetre	**+0.47**	**+0.61**	**+0.33**	**+0.21**	**+0.52**	**+0.31**	**+0.3**
	Girls.		+0.56	+0.70	+0.53	+0.54	+0.79	+0.49	+0.6
Root of Nose to Point of Chin.	**Boys.**	Millimetre	**—0.52**	**—0.30**	**—0.20**	**—0.09**	**—0.33**	**—0.14**	**+0.2**
	Girls.		—0.53	—0.57	—0.05	—0.25	—0.37	—0.24	+0.0
Width of Face	**Boys.**	Millimetre	**+0.96**	**+0.62**	**+0.93**	**+0.84**	**+0.03**	**+0.49**	**+0.7**
	Girls.		+0.68	+0.27	—0.18	+0.79	+0.93	+0.47	+0.6
Hair Line to Point of Chin.	**Boys.**	Millimetre	**+0.34**	**+0.76**	**+0.54**	**+0.82**	**+0.33**	**+0.72**	**+0.3**
	Girls.		+0.39	+0.83	+0.41	+0.32	+0.52	+0.85	+0.6

TABLE No. 11 — *Continued.*

MEDIAN MINUS AVERAGE VALUES.

Age at Nearest Birthday, and Median Minus Average Values.									Dimensions.
13	14	15	16	17	18	19	20	21	
—0.36 —0.49	**—0.46** +0.36	**—0.73** +0.16	**+0.23** —0.29	**—0.36** —0.09	+0.74	+0.28	—0.34		Weight.
+0.38 —0.34	**+0.28** +1.10	**+0.35** +0.78	**+1.00** +0.51	**+0.87** +0.07	**+0.09** +0.08	+1.10	+0.42	+0.52	Height Standing.
+0.29 +0.49	**—0.13** +0.93	**—0.07** +0.78	**+0.94** +0.74	**+0.94** +0.75	**—0.53** +0.69	+0.82	+0.69	+0.74	Height Sitting.
+0.24 +0.64	**+0.34** +0.98	**+0.36** —0.17	**+1.35** +0.80	**+1.02** +0.61	**+0.19** +0.91	+0.45	+1.33	—0.39	Span of Arms.
+0.39 +0.30	**+0.23** +0.43	**+0.24** +0.12	**+1.01** +0.57	**+0.90** +0.41	**+1.23** +0.48	+0.90	+0.80	—0.64	Girth of Chest, Inspiratio
+0.41 +0.40	**+0.08** +0.48	**+0.52** +0.17	**+0.35** +0.16	**+0.72** +0.26	**+0.44** +0.45	+0.51	+0.41	+0.61	Girth of Chest, Expiratio
—0.09 —0.62	**—0.50** —0.24	**—0.52** +0.31	**—1.14** —0.18	+0.37	+0.75	+0.43	—0.11		Strength of Squeez Right Hand.
—0.36 —0.12	**—0.50** —0.69	**+0.08** +0.41	**+0.54** —0.08	**+0.60** —0.10	+0.02	+0.38	+0.48	—0.28	Strength of Squeez Left Hand.
+0.37 +1.04	**—0.69** +1.30	**+0.68** +0.55	**+0.98** +0.86	**+1.48** +0.46	**—0.16** +0.44	+0.40	+0.27		Length of Head.
+0.27 +0.37	**+0.54** +0.35	**+0.78** +0.42	**+0.37** +0.72	**+0.41** +0.39	**+0.34** +1.07	+1.06	—0.12		Width of Head.
+0.10 —0.21	**+0.08** —0.15	**—0.11** —0.39	**+0.10** —0.61	**+0.94** +0.46	**+0.16** +0.27	—0.38	+0.04	—0.06	Root of Nose to Point of Chi
+0.19 +0.71	**+0.51** +0.84	**+0.71** +0.45	**+0.55** +0.71	**+1.79** +0.75	**+0.75** +0.55	+0.20	+1.29		Width of Face.
+0.54 +0.80	**+0.55** +0.62	**+0.78** +0.65	**—0.26** +0.53	**—0.03** +0.90	**+1.99** +0.96	—1.83	—0.09	+1.78	Hair Line to Point of Chi

either may be used for the type without any error of practical importance, provided the series are similar to those analyzed here. This point is of practical interest because the labor of reckoning the average is much greater than in reckoning the median value.

Bowditch, in *The Growth of Children*, Boston, 1891, p. 495 *et seq.*, discusses the relation of median and average value. "It is evident," he writes, "that the value M will tend to "approximate to the average value of all the observations and "will be identical with it when the [percentile] curve S T "is symmetrically disposed on both sides of M, *i. e.*, when "the values at sixty, seventy, eighty, ninety and ninety-five "per cent. exceed M by the same amount, respectively, by "which the values at forty, thirty, twenty, ten and five per "cent. fall short of it. If A represent the average value of "all the observations, then the value of M–A will be a meas-"ure of the direction and extent of the asymmetry of the "curve S T, *for this value will be zero when the curve is sym-"metrical, positive when the values at the lower percentile "grades fall short of M more than those at the higher grades "exceed it, and negative when the reverse is the case.*" [Dr. Bowditch now gives a table of median minus average height and weight.] "An examination of this table or of the curves "constructed from it, as given in Plate I, shows that the "asymmetry of the curves of percentile grades varies very "much, at different ages, both in direction and amount. The "variation in the value of M–A in the curves of height is much "the same as that in the curves of weight for each sex consid-"ered by itself, but there is a great difference between the "two sexes. This difference shows itself most distinctly "between the ages of eleven and fifteen years. During this "time a rise in the curves for the males coincides with a fall "in those for the females, while before and after this period "the curves, as a rule, rise and fall together. We must con-"clude, therefore, that the rate of annual increase, both in "height and weight, is different at different percentile grades, "or, in other words, that large children grow differently from "small ones, and moreover, that between the ages of eleven "and fifteen years there is a striking difference in the mode "of growth of the two sexes."

Table No. 11 and the curves constructed from it (Plates II, III, IV) furnish considerable material for the study of the relation between median and average values. The curves of median minus average height agree with those of Dr. Bowditch in showing (1) a difference in the rate of growth of the same sex at different percentile grades, (2) an agreement in the rate of growth of the sexes from age 6 to 12, inclusive,* and (3) a marked difference in the rate of growth from age 12 to age 16, beyond which the number of observations is perhaps too small for sure work. In the curves from both cities, moreover, the greatest asymmetry in girls is near age 13, and in boys near age 16, the culmination being a little later in St. Louis children, and the least asymmetry is near age 12. The asymmetry of Boston boys' curves at age 15 and girls' curves at ages 16 and 17 is somewhat greater than that of the St. Louis curves. It is further worthy of notice that the values in the case of St. Louis boys do not become negative.

There is a general similarity also between the median minus average weights of the children of the two cities, the asymmetry of girls being again greatest about age 14 and of boys greatest at about age 16. Dr. Bowditch's conclusions, quoted above, are therefore fully confirmed.

The St. Louis curves on Plates II, III and IV should now be compared with each other. The maximum asymmetry of girls about 14 years and boys about 16 years old, appears in weight, height, height sitting, and span of arms, while the remaining curves exhibit no characteristic sexual differences during the period of prepubertal acceleration. The asymmetry is for the most part positive, weight, strength of squeeze and height of face from root of nose to point of chin being the only considerable exceptions. Sexual differences, aside from those already mentioned, are unimportant, save perhaps in length and width of head, in both of which the asymmetry of girls is greater than that of boys from age 6 to age 13.

The errors in the median minus average values of height, weight and other single dimensions may be partially compensated by adding the median minus average values of several dimensions of each sex and age, without regard to plus or minus sign. This has been done in Table No. 12.

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* It should be remembered that Dr. Bowditch's ages are recorded at last birthday, while mine are recorded at nearest birthday.

TABLE No. 12.

SUMS OF MEDIAN MINUS AVERAGE VALUES.

Age at Nearest Birthday.	Weight, Height Standing, Height Sitting, Span of Arms.		Girth of Chest at Full Inspiration and Expiration.		Strength of Squeeze, Right and Left Hand.		Head and Face Measurements.	
	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.
6	1.55	1.48	0.54	1.06	0.74	1.48	2.76	3.05
7	1.22	1.89	0.54	0.79	0.06	0.57	2.67	2.86
8	1.86	1.60	0.73	1.05	0.23	0.35	2.82	2.40
9	1.52	1.16	0.86	1.04	0.89	0.27	2.24	3.31
10	1.51	1.58	0.66	0.89	0.24	0.65	1.27	3.89
11	1.56	1.57	0.87	1.03	0.31	0.29	2.15	3.72
12	0.71	1.92	0.81	0.31	0.43	0.12	1.99	3.10
13	1.27	1.96	0.80	0.70	0.45	0.74	1.47	3.13
14	1.21	3.37	0.31	0.91	1.00	0.93	2.37	3.26
15	1.51	1.89	0.76	0.29	0.60	0.72	3.06	2.46
16	3.52	2.34	1.36	0.73	1.68	0.26	2.26	3.43
17	3.19	1.52	1.62	0.67	....	0.47	4.65	2.96
18	....	2.42	1.77	0.93	....	0.77	3.40	3.29

The conclusions drawn from the curves discussed above are substantiated in the main by this table. It is, however, difficult to believe that a sexual difference such as exists in weight, height standing, height sitting and span of arms will not be found also in girth of chest and the various dimensions of the head. But a purely objective attitude towards the material in hand does not permit speculation as to what might be revealed if the material were very much larger and its intrinsic laws easier to unveil.

CHAPTER IV.

DANGERS OF COMPARING MEASUREMENTS OF CHILDREN IN DIFFERENT COUNTRIES. INFLUENCE OF OCCUPATION AND NATIONALITY OF PARENTS.

It has been a custom of anthropometrists to compare the type-children of cities, states or provinces very different in situation and character. Such comparisons may be expected always to show that the laws of growth are in their main features the same for all children. They cannot, however, be expected to give very definite information in regard to the relative size of children of different countries or districts so long as the social status or environment of the children is not more closely studied. The children in the public schools are from all classes of society, and it has been demonstrated repeatedly that the favored classes differ physically from the poor. The children of the prosperous have been found to be larger than the children of the poor. The comparison of middle values got from two sets of schools is therefore open to the objection that the composition of the school population may not be the same in both sets. It would for example be unsafe to say that St. Louis children are larger or smaller than Copenhagen children because the type-children in the St. Louis Public Schools are larger or smaller than the type-children in Copenhagen, for the difference observed may depend on the different composition of the school population in the two cities.

Such comparisons, when rightly made, are not only of great scientific interest but are almost essential to the use of anthropometrical systems in education. An immense saving of time would be made if it were shown that the typical height, weight, etc., of children in one city of a country could be adopted as the standard for the schools of the entire country or even a considerable part of it. And in any one city, the application of the type-values to individuals would be much less liable to error if it were known how much allowance should be made for the difference between the type of a special social class and the types of a mixed school population. Every investigation of the present kind should, therefore, include information concerning the social condition of the children. The tax-returns are available for this purpose, and the occupation of parents is also of use. It was not possible to inquire into tax-returns in the present research, but some facts can be communicated regarding the physical differences between the children of professional and business men and those of manual tradesmen. The occupations included under these heads may be seen in the following statement of the occupations of the fathers of 2,000 St. Louis children. The names of occupations are set down as given by the pupils.

PROFESSIONS.

Artist	3	Minister	6
Chemist	1	Medical Student	1
Civil Engineer	3	Musician	6
Dentist	4	Photographer	3
Editor	6	Physician	13
Electrical Engineer	4	Teacher	9
Electrician	2	Veterinarian	1
Lawyer	14		
Total			76

MERCANTILE CLASS.

Agent	36	Dealer in Furniture	6
Banker	2	Hardware	2
Book-keeper	40	Hats	1
Broker	9	Horses	1
Cashier	8	Lime	1
Clerk	3	Lumber	4
Collector	8	Marble	1
Contractor	20	Pork	2
Dairyman	8	Produce	2
Drugs	10	Stationery	1
Dealer in Butter	1	Stone	1
Carpets	2	Tobacco	5
Cattle	4	Wall-paper	1
Cloth	4	Foreman	24
Clothes	1	Grocer	36
Corn	2	Hotel-keeper	5
Coal	4	Inspector, Building	2
Feed and Flour	2	Street	7
Fish and Oysters	3	Not specified	1
Fruits	3	Jeweler	7

Insurance	4
Manager	7
Manufacturer	35
Merchant	143
Merchant Tailor	2
News-depot	1
Optician	2
Postmaster	1

President of Iron Co.	1
Publisher	1
Real Estate	7
Salesman	76
Secretary of a corporation	6
Telegrapher	1
Traveling Salesman	9
Undertaker	3

Total	579

MANUAL TRADES.

Baker	24
Barber	23
Blacksmith	29
Book-Binder	2
Brewer	14
Bricklayer	21
Builder	9
Butcher	40
Carpenter	148
Carriage Repairer	2
Cigar Packer	1
Cloth Sponger	1
Compositor	2
Confectioner	7
Cook	5
Cooper	37
Coppersmith	1
Cord-Wainer	1
Dairyman	1
Decorator	4
Draughtsman	5
Dressmaker	4
Dyer	2
Engineer	43
Engraver	1
Fireman	11
Foundryman	2
Gardener	5
Gilder	1
Glass Blower	2
Iron Worker	3
Laundryman	1
Lithographer	1
Locksmith	1
Maker of:	
Bags	2
Baskets	1
Belts	1

Maker of:	
Boilers	7
Boxes	9
Brushes	3
Candies	3
Carriages	16
Chains	2
Chairs	2
Cigars	31
Collars	1
Cornices	1
Harness	2
Lanterns	1
Mattresses	1
Models	1
Organs	1
Patterns	4
Shoes	47
Tobacco	3
Trunks	1
Wagons	6
Watches	6
Machinist	55
Maltster	4
Marble Cutter	3
Mechanic	42
Miller	7
Millwright	5
Miner	1
Molder	33
Motorman	2
Packer	5
Painter	51
Paper-Hanger	8
Paver	4
Pipe-Fitter	2
Planer	1
Plasterer	10

Plumber	13	Tailor	56
Polisher	1	Tanner	6
Potter	2	Tinner	15
Printer	19	Turner	6
Puddler	1	Upholsterer	5
Saddler	12	Varnisher	5
Selector of Tobacco	1	Waterproofer and Painter	1
Shoe Varnisher	1	Weaver	1
Slater	1	Whitener	14
Stair Builder	4	Wood-Worker	38
Stone Mason	50		
Total			1086

LABORERS.

Baggageman	2	Oiler	2
Carriers, Letter	9	Peddler	19
Carriers, Paper	6	Policeman and watchman	21
Coal-heaver	1	Porter	4
Driver	3	Riverman	1
Elevator man	1	Railway-hand	12
Engine-cleaner	1	Saloon-keeper	51
Expressman	3	Sexton	1
Fireman	11	Shepherd	1
Gripman	6	Steward, Hotel	2
Hostler	7	" Steamer	1
Huckster	2	"	3
Janitor	3	Teamster	6
Laborer	31	Waiter	1
Live-stock driver	1		
Lumberman	1	Total	216
Mill-hand	4		

MISCELLANEOUS.

Captain of Steamer	1
Conductor	14
Farmer	12
"Independent"	1
Pilot	5
No occupation	7
"Retired"	3
Total	43

SUMMARY.

Professions	76
Mercantile classes	579
Manual trades	1086
Laborers	216
Miscellaneous	43
Total	2000

The number of children of rich families and of very poor families in the public schools is small, the larger part of the pupils being from what would be called in England the lower middle class, and the school population is accordingly more homogeneous than would have seemed possible at the first glance.

The difference in the weight of children of the professional and merchant class is probably of little importance until the period of prepubertal acceleration. Such at least is the inference from Table No. 13, where the weights of these two classes are compared.

TABLE No. 13.

A COMPARISON OF THE WEIGHTS OF THE DAUGHTERS OF MANUAL TRADESMEN WITH THE WEIGHTS OF THE DAUGHTERS OF PROFESSIONAL MEN AND MERCHANTS.

Professional Men and Merchants.			Manual Tradesmen.		
Age at Nearest Birthday.	Number of Observations.	Median Weight. (Kilogrammes)	Median Weight. (Kilogrammes)	Number of Observations.	Age at Nearest Birthday.
6	74	19.53	18.95	237	6
7	148	20.63	20.74	604	7
8	170	23.00	22.89	723	8
9	152	25.48	25.09	688	9
10	168	27.61	27.46	651	10
11	173	30.63	29.45	569	11
12	153	33.86	32.28	556	12
13	160	39.04	37.07	402	13
14	140	43.59	41.68	251	14
15	112	47.49	45.62	145	15
16	87	50.16	49.18	52	16
17	46	53.58	51.07	24	17

What is true of weight is in this instance probably true of the physical development as a whole, and Table No. 13 would seem to indicate that a wide difference in social status or material prosperity may exist without much influencing the growth of children up to the prepubertal acceleration. But further investigation is necessary before a generalization can be made. It must suffice here to state: 1. The daughters of professional men and merchants are very little heavier than the daughters of manual tradesmen until the period of prepubertal acceleration. 2. The weight of girls is much more influenced by the material prosperity or social status of parents during and immediately after the period of prepubertal acceleration than in the earlier years of growth.

The proportion of children of the more prosperous class in the public schools is not the same in all grades. In the higher grades, containing the older children, the number from prosperous families is relatively larger, the children of the poor having in many instances been compelled to leave school in order to earn money. Some idea of the extent of this change may be gained from Table No. 14, in which the per cent. of daughters of professional men and merchants and daughters of manual tradesmen is given at each age and school grade.

TABLE No. 14.

The Percentile Distribution by School Grade of the Daughters of Merchants and Professional Men (*i. e.* favored classes) compared with that of the Daughters of Manual Tradesmen (hand-workers).

Age at nearest Birthday.	Number of Individuals.	Percentile Distribution by School Grades. Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	
Six	44	95.4	4.6								Professions.
	141	91.5	8.5								Trades.
Seven	102	46.1	48.0	5.9							Professions.
	341	40.0	54.8	5.2							Trades.
Eight	105	2.0	49.5	46.6	2.0						Professions.
	440	2.0	65.4	30.9	1.4	0.2					Trades.
Nine	110		10.0	60.0	28.6	4.5	1.8				Professions.
	439		23.7	57.8	16.2	2.3					Trades.
Ten	119		1.7	26.9	45.4	23.5	1.7	0.8			Professions.
	386		5.7	39.9	44.3	8.5	1.0	0.5			Trades.
Eleven	116		0.9	12.0	24.1	50.0	11.2	0.9	0.9		Professions.
	355		2.5	15.5	41.2	33.0	7.6	0.8			Trades.
Twelve	108		0.9	3.7	13.9	37.0	28.7	13.0	0.9	1.9	Professions.
	357		0.6	7.6	19.6	40.0	21.8	9.8	0.3		Trades.
Thirteen	121			2.5	4.1	18.9	31.4	24.8	11.6	6.6	Professions.
	304		0.7	3.3	12.2	27.3	25.0	20.7	9.9	1.0	Trades.
Fourteen	89				3.4	5.6	18.0	32.6	20.2	20.2	Professions.
	177			1.1	4.5	14.7	25.4	29.2	15.8	9.0	Trades.
Fifteen	65				1.5	1.5	10.8	29.2	21.5	35.4	Professions.
	110				1.8	7.1	14.5	32.7	20.0	23.6	Trades.
Sixteen	37					2.7	2.7	21.6	35.1	37.7	Professions.
	24					4.2	8.3	16.7	29.2	41.7	Trades.

The ratio between the two is more easily grasped when the difference between the classes at each age and grade is stated, black type being used where the professional and merchant class exceed the tradesmen's daughters and lower case type where the contrary is true.

Age.	Kinder-garten.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
6	**3.9%**	3.9%	%	%	%	%	%	%	%
7	**6.1**	6.8	**0.7**	....	......	......	......	......	......
8	0.0	15.9	**15.7**	**0.6**	......	......	......	......	......
9	....	13.7	**2.2**	**7.4**	**2.2**	......	......	......	......
10	....	4.0	13.0	**1.1**	**15.0**	**0.7**	**0.8**	......	......
11	....	1.6	3.5	17.1	**17.0**	**3.6**	**0.1**	......	......
12	....	**0.8**	3.9	5.7	3.0	**6.9**	**3.2**	**0.6**	......
13	....	....	0.8	8.1	8.4	**6.4**	**4.1**	**1.7**	**5.6**
14	....	....	....	1.1	9.1	7.4	**3.4**	**4.4**	**11.2**
15	....	....	....	0.3	5.6	3.7	3.5	**1.5**	**11.8**
16	....	....	....	....	1.5	5.6	**4.9**	**5.9**	**4.0**

The number of boys withdrawn from school to earn money is of course greater than the number of girls withdrawn. Thus of 562 boys, aged 6, 17.8 per cent. were sons of professional men or merchants and 42.9 per cent. sons of manual tradesmen, while at age 14, 29.3 per cent. of 498 boys were from the former class and 37 per cent. from the latter.

Age at Nearest Birthday.	Number of Individuals.	Sons of Professional Men and Merchants.	Sons of Manual Tradesmen.	Others.
6	562	17.8%	42.9%	39.3%
14	498	29.3	37.0	33.7

The nationality of the children should be considered in an anthropometrical inquiry. It is well known that children of the same age but different nationality exhibit differences in physical development. The annual report of the Superintendent of Public Schools, issued Aug. 1, 1891, contains in Table V, appendix, page XLVI, a statement "Showing the Birthplace of Pupils Registered in Each School for the Year 1890–91," from which the number of pupils in the schools in which the measurements were made has been taken and the following percentages calculated: —

BIRTHPLACE OF 46,870 PUPILS IN THE ST. LOUIS PUBLIC SCHOOLS.

St. Louis	79.26 %
Other Parts of the United States	16.92 "
Great Britain	0.63 "
Ireland	0.19 "
German States	1.97 "
Other Foreign Countries	0.87 "
Unknown	0.16 "
Total	100

The children of foreign birth are too few to affect the results of the measurements, and the number of children born in or near St. Louis is such that the middle values obtained must be taken as characteristic for this community.

The children of foreign parentage are of course much more numerous than those of foreign birth. The number of Germans is especially large. The median weights of boys and girls whose parents were born in Germany are compared in Tables No. 15 and 16, with children of American parentage.

TABLE No. 15.[*]

THE WEIGHTS OF GIRLS WHOSE PARENTS WERE BORN IN GERMANY COMPARED WITH THE WEIGHTS OF GIRLS WHOSE PARENTS WERE BORN IN THE UNITED STATES.[†]

GERMAN.			AMERICAN.		
Age at Nearest Birthday.	Number of Observations.	Median Weight. (Kilogrammes)	Median Weight. (Kilogrammes)	Number of Observations.	Age at Nearest Birthday.
6	310	19.15	18.76	398	6
7	683	20.86	20.82	861	7
8	796	23.17	22.71	1082	8
9	796	25.09	25.07	1023	9
10	725	27.65	27.43	1029	10
11	753	29.61	29.93	808	11
12	715	33.42	33.17	779	12
13	518	37.58	38.29	648	13
14	331	42.56	43.12	565	14
15	186	46.77	46.90	403	15
16	86	49.73	50.06	265	16
17	49	53.93	52.12	131	17
18	43	52.59	54.03	100	18
19	22	54.26	52.90	40	19
20			52.67	33	20

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[*] The birth-place of the girls themselves is not considered in this table.

[†] A few were born in Canada.

TABLE No. 16.*

THE WEIGHTS OF BOYS WHOSE PARENTS WERE BORN IN GERMANY COMPARED WITH THE WEIGHTS OF BOYS WHOSE PARENTS WERE BORN IN THE UNITED STATES.†

GERMAN.			AMERICAN.		
Age at Nearest Birthday.	Number of Observations.	Median Weight. (Kilogrammes)	Median Weight. (Kilogrammes)	Number of Observations.	Age at Nearest Birthday.
6	158	20.04	19.66	263	6
7	334	21.93	21.67	756	7
8	426	23.98	23.91	907	8
9	369	26.64	26.08	878	9
10	370	28.51	28.49	847	10
11	358	31.21	31.26	663	11
12	385	33.51	33.45	549	12
13	321	35.92	35.96	437	13
14	166	39.59	40.34	352	14
15	106	44.68	47.25	219	15
16	26	52.22	52.10	92	16
			55.14	40	17

The difference in weight is seen to be of no great importance.

In the absence of special investigations of the influence of social condition and the nationality of parents on the growth of children, it is impossible to estimate accurately to what degree middle values, calculated without regard to social condition and nationality, are affected by these factors. The data presented in this chapter go to show that the middle values of St. Louis children are little influenced by considerable differences in social condition before the period of prepubertal acceleration and are not very largely influenced by such differences during this period. Further, these values are at no time much affected by differences in nationality of parents not greater than those existing between Germans and Americans. But the whole question evidently requires extended study of data difficult or impossible of collection by private hands.

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* The birth-place of the boys themselves is not considered in this table.

† A few were born in Canada.

CHAPTER V.

PERCENTILE GRADES OF WEIGHT, HEIGHT STANDING, HEIGHT SITTING, SPAN OF ARMS, GIRTH OF CHEST, LENGTH OF HEAD, WIDTH OF HEAD, HEIGHT OF FACE FROM ROOT OF NOSE TO POINT OF CHIN, WIDTH OF FACE, AND HEIGHT OF FACE FROM HAIR LINE TO POINT OF CHIN.

The Percentile Grades of weight, height, etc., presented in Tables No. 17 to No. 28, inclusive, are represented graphically in Plates V to XXIV. By their aid, the percentile rank of an individual in respect of weight, span of arms or any physical dimension included in the tables can be easily and quickly determined. Suppose, for example, the percentile rank of a boy, aged 11, weighing 32 kg. was desired. A horizontal line is drawn from 32 in the column of kilogrammes on the left of Plate V to the curve of age 11, and a perpendicular is dropped from the point of intersection to the scale of percentile grades at the bottom of the plate. The perpendicular falls at 60 per cent. Hence the boy is heavier than 60 per cent. of boys of his age and lighter than 40 per cent.

Other facts are made plain by these curves. The increase at any percentile grade during one or more years is expressed by the distance between the curves at that grade. Thus, in Plate V, the gain in weight of the type-boy in the 15 percentile grade during the years 6 to 11 inclusive is 9.3 kg., and the gain at the 85 percentile grade during the same year 13.0 kg. The difference in size between large and small boys of the same age appears in the inclination of the curve to its axis, the slope being steepest in the years of quickest growth. And finally, the tendency of the greater number of individuals to approximate the middle value of their group is illustrated, the inclination of each curve being much less at the central part than at the ends, where the giants and the dwarfs are found. The principal service of such curves, however, is to determine percentile rank.

TABLE No. 19.

THE HEIGHT SITTING.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six..........	**Boys.**	**714**	**56.28**	**57.50**	**58.71**	**59.50**	**60.17**	**60.77**	**61.52**	**62.42**	**63.61**	**65.81**	**68.58**	**61.81**
	Girls.	751	55.19	56.28	57.68	58.78	59.41	60.11	60.80	61.59	62.50	63.68	64.75	59.45
Seven	**Boys.**	**1853**	**58.41**	**59.50**	**60.72**	**61.60**	**62.42**	**63.22**	**63.98**	**64.77**	**65.66**	**67.88**	**69.19**	**63.82**
	Girls.	1727	57.41	58.65	60.16	60.99	61.80	62.44	63.28	64.12	65.00	66.08	67.20	61.80
Eight.........	**Boys.**	**2239**	**60.21**	**61.38**	**62.70**	**63.74**	**64.52**	**65.21**	**65.87**	**66.69**	**67.65**	**69.01**	**70.82**	**64.74**
	Girls.	2120	60.22	61.00	62.27	63.14	64.01	64.96	65.22	65.82	66.92	68.21	69.27	63.97
Nine	**Boys.**	**2258**	**62.10**	**63.16**	**64.59**	**65.50**	**66.29**	**67.08**	**67.93**	**68.82**	**69.79**	**71.17**	**72.48**	**66.78**
	Girls.	2071	61.79	62.99	64.26	65.30	66.00	66.19	67.52	68.33	69.28	70.59	71.81	66.16
Ten	**Boys.**	**2118**	**63.70**	**65.49**	**66.85**	**67.45**	**68.37**	**69.18**	**69.98**	**70 84**	**71.86**	**73.46**	**74.79**	**69.25**
	Girls.	2037	63.46	64.86	66.19	67.22	68.06	68.88	69.61	70.48	71.49	72.79	74.02	68.19
Eleven	**Boys.**	**1828**	**65.23**	**66.62**	**68.29**	**69.27**	**70.23**	**71.09**	**71.84**	**72.70**	**73.75**	**75.28**	**76.68**	**70.67**
	Girls.	1748	65.15	66.27	67.83	68.08	69.89	70.62	71.42	72.36	73.51	75.08	76.37	70.08
Twelve.......	**Boys.**	**1656**	**67.62**	**68.35**	**70.08**	**70.89**	**71.84**	**72.68**	**73.56**	**74.50**	**75.56**	**77.00**	**78.81**	**72.55**
	Girls.	1707	66.06	68.46	70.21	71.16	72.39	73.22	74.21	75.26	76.29	78.24	79.09	72.67
Thirteen......	**Boys.**	**1285**	**68.68**	**70.02**	**71.45**	**72.61**	**73.58**	**74.49**	**75.75**	**76.27**	**77.48**	**79.24**	**81.00**	**74.20**
	Girls.	1354	69.99	71.44	73.15	74.40	75.46	76.52	77.64	78.47	80.41	82.06	83.48	76.03
Fourteen......	**Boys.**	**936**	**70.49**	**71.78**	**73.76**	**74.97**	**75.88**	**76.71**	**77.84**	**79.08**	**80.71**	**82.85**	**85.87**	**76.84**
	Girls.	1065	71.54	73.83	75.79	77.20	78.29	79.61	80.59	81.59	82.87	84.74	85.95	78.68
Fifteen.......	**Boys.**	**498**	**72.66**	**74.28**	**75.84**	**77.17**	**78.41**	**79.67**	**81.08**	**82.70**	**84.75**	**86.58**	**88.51**	**79.74**
	Girls.	674	75.34	77.05	79.17	80.34	81.27	82.20	83.12	84.04	85.12	86.55	87.72	81.42
Sixteen.......	**Boys.**	**193**	**74.66**	**76.87**	**78.78**	**80.00**	**82.00**	**83.22**	**84.57**	**85.78**	**86.86**	**89.14**	**91.89**	**82.28**
	Girls.	411	78.93	80.77	81.67	82.65	83.54	84.50	85.34	86.00	87.08	88.11	89.57	83.76
Seventeen	**Boys.**	**77**	**77.84**	**79.84**	**82.47**	**84.22**	**85.42**	**86.22**	**88.08**	**89.10**	**90.00**	**92.82**	**94.07**	**85.68**
	Girls.	202	80.44	81.62	82.19	83.81	84.66	85.41	86.20	86.90	87.70	89.10	90.32	84.66
Eighteen	**Boys.**	**81**		**84.10**	**85.40**	**86.82**	**87.08**	**87.70**	**89.60**	**91.57**	**93.20**	**93.98**	**94.72**	**88.28**
	Girls.	167	81.47	82.44	83.78	84.74	85.37	85.89	86.51	87.18	87.94	88.85	90.87	85.20
Nineteen......	Girls.	85	80.81	81.58	83.50	84.42	85.07	85.68	86.29	86.89	87.64	88.56	89.75	84.86
Twenty	Girls.	78	80.95	82.13	83.65	84.64	85 85	86.00	86.78	87.66	88.49	89.60	90.28	85.81

TABLE No. 20.

THE SPAN OF ARMS.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	**Boys.**	**708**	**100.76**	**102.45**	**105.00**	**106.32**	**108.27**	**109.57**	**110.70**	**112.94**	**114.26**	**117.00**	**119.00**	**108.95**
	Girls.	769	98.43	100.36	102.87	105.49	106.57	106.96	108.77	110.42	112.39	115.16	117.07	106.96
Seven	**Boys.**	**1862**	**105.23**	**107.30**	**110.17**	**112.00**	**113.58**	**115.08**	**116.19**	**117.88**	**119.85**	**122.26**	**124.18**	**114.42**
	Girls.	1724	103.14	105.21	107.60	109.81	111.34	113.11	114.70	116.63	117.91	120.65	122.76	112.36
Eight	**Boys.**	**2234**	**110.28**	**112.75**	**115.60**	**117.44**	**119.13**	**120.73**	**122.22**	**123.66**	**125.76**	**128.43**	**130.49**	**120.07**
	Girls.	2152	108.52	111.85	113.79	115.61	117.29	118.13	120.38	121.94	123.11	126.80	128.90	118.34
Nine	**Boys.**	**2272**	**115.76**	**118.18**	**120.70**	**122.40**	**124.14**	**125.67**	**127.15**	**128.99**	**130.86**	**133.84**	**136.45**	**125.18**
	Girls.	2065	113.60	115.85	119.19	121.11	122.57	124.28	125.75	127.37	129.46	131.96	134.75	123.63
Ten	**Boys.**	**2076**	**119.57**	**122.15**	**125.21**	**127.16**	**129.03**	**130.61**	**132.47**	**134.48**	**136.49**	**139.66**	**141.74**	**130.22**
	Girls.	2045	118.24	120.67	123.63	125.63	127.30	129.18	130.77	132 54	134.94	138.81	140.89	128.75
Eleven	**Boys.**	**1810**	**124.46**	**126.77**	**129.92**	**131.87**	**133.79**	**135.59**	**137.58**	**139.64**	**141.50**	**144.67**	**147.25**	**135.13**
	Girls.	1757	122.78	125.27	128.22	130.62	132.61	134.56	136.17	138.17	140.78	144.92	147.00	134.24
Twelve	**Boys.**	**1664**	**128.55**	**131.00**	**134.51**	**136.58**	**138.69**	**140.48**	**142.30**	**144.35**	**146.50**	**150.18**	**153.19**	**140.60**
	Girls.	1718	127.45	130.34	133.90	136.33	138.59	140.60	142.50	144.74	147.36	151.32	154.36	140.07
Thirteen	**Boys.**	**1281**	**132.33**	**135.35**	**138.75**	**141.40**	**143.28**	**145.33**	**147.43**	**150.05**	**152.69**	**156.96**	**159.62**	**145.09**
	Girls.	1368	134.95	137.49	140.69	143.50	145.88	147.83	150.25	152.18	154.59	158.40	160.55	147.19
Fourteen	**Boys.**	**934**	**138.21**	**141.06**	**144.72**	**147.28**	**149.48**	**151.62**	**154.11**	**156.00**	**158.72**	**163.20**	**167.32**	**151.28**
	Girls.	1088	139.60	142.92	146.81	149.79	151.84	153.56	155.36	157.38	159.70	162.38	164.70	152.58
Fifteen	**Boys.**	**495**	**140.96**	**145.36**	**150.32**	**153.30**	**156.21**	**158.79**	**161.24**	**164.00**	**168.07**	**173.17**	**177.58**	**158.43**
	Girls.	677	145.68	148.48	151.29	153.94	155.32	156.21	158.52	160.43	162.39	165.55	168.24	156.38
Sixteeen	**Boys.**	**189**	**145.82**	**150.22**	**156.30**	**159.78**	**162.74**	**165.31**	**167.91**	**169.88**	**173.10**	**176.89**	**180.55**	**163.96**
	Girls.	413	148.13	150.55	154.35	156.43	157.61	159.31	160.80	162.26	164.26	167.39	170.15	158.51
Seventeen	**Boys.**	**75**	**154.50**	**159.50**	**163.66**	**165.87**	**167.75**	**169.58**	**170.83**	**174.10**	**176.66**	**180.25**	**183.50**	**168.56**
	Girls.	202	149.20	151.40	154.43	156.29	157.88	159.62	160.88	162.53	164.37	167.13	169.30	159.01
Eighteen	**Boys.**	**32**	**166.20**	**168.10**	**170.40**	**171.87**	**172.93**	**175.50**	**177.40**	**178.47**	**181.40**	**184.80**	**186.40**	**175.81**
	Girls.	164	150.30	152.68	155.54	157.76	160.05	161.38	162.65	164.52	166.30	169.10	170.93	160.47
Nineteen	Girls.	83	147.00	151.30	154.60	155.74	157.05	158.90	160.83	161.89	164.28	168.70	170.28	158.45
Twenty	Girls.	76	151.80	153.80	155.64	157.26	158.80	161.50	162.93	164.03	165.93	168.47	169.55	160.17
Twenty-one ..	Girls.	37		153.70	156.47	158.33	159.80	160.88	163.80	165.95	167.40	169.50	171.15	161.27

TABLE No. 21.

The Girth of Chest at Full Inspiration.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	Boys.	674	56.05	57.18	58.72	59.87	60.36	61.04	61.73	62.59	63.75	65.59	67.04	60.84
	Girls.	739	54.77	56.41	57.52	58.64	59.51	60.26	60.92	61.69	62.81	64.42	66.04	59.68
Seven	Boys.	1702	57.74	58.98	60.26	61.25	62.47	62.86	63.70	64.69	65.82	67.45	69.87	62.56
	Girls.	1603	55.99	57.26	58.75	59.96	60.75	61.43	62.39	63.84	64.55	66.14	67.68	61.15
Eight	Boys.	2114	59.82	60.57	62.14	63.10	64.00	64.46	65.76	66.70	67.73	69.21	70.28	64.29
	Girls.	2044	57.80	58.91	60.28	61.82	62.27	63.19	64.18	65.03	66.10	67.69	68.79	62.62
Nine	Boys.	2118	61.88	62.18	63.61	64.68	65.64	66.51	67.41	68.42	69.59	71.16	72.49	66.02
	Girls.	1964	59.87	60.33	61.95	63.10	64.06	64.87	65.73	66.80	67.89	69.52	71.00	64.81
Ten	Boys.	2000	62.88	63.68	65.20	66.60	67.40	68.31	69.28	70.28	71.46	73.41	75.30	67.87
	Girls.	1891	59.86	60.26	61.85	63.00	63.93	66.46	67.41	68.46	69.67	71.15	72.81	65.97
Eleven	Boys.	1782	64.08	65.32	67.13	68.88	69.28	70.16	70.92	71.97	73.86	75.44	77.25	69.69
	Girls.	1648	62.35	63.26	64.91	66.16	67.88	68.45	69.61	70.48	71.61	73.84	75 81	67.90
Twelve	Boys.	1568	65.44	66.86	68.66	69.98	70.91	71.84	72.97	73.99	75.82	77.80	78.96	71.48
	Girls.	1628	63.64	65.31	67.29	68.50	69.55	70.61	71.77	73.11	74.81	77.14	79.23	70.42
Thirteen	Boys.	1240	66.88	68.20	70.78	71.84	72.59	73.70	74.88	76.17	77.76	79.95	82.00	73.81
	Girls.	1315	65.89	67.53	69.85	71.20	72.37	73.65	74.98	76.84	77.96	80.62	82.84	73.85
Fourteen	Boys.	920	69.21	70.60	72.48	73.90	75.25	76.44	77.95	79.82	80.96	83.58	85.74	76.21
	Girls.	1021	68.44	70.83	72.46	73.98	75.48	76.82	78.84	79.77	81.84	83.61	85 68	76.89
Fifteen	Boys.	497	71.55	73.43	75.68	77.12	78.62	79.99	81.58	83.27	85.28	87.71	89.57	79.75
	Girls.	660	71.19	73.08	75.17	76.69	78.26	79.07	80.64	82.71	83.84	85.87	88.25	78.95
Sixteen	Boys.	206	72.10	74.65	78.02	79.75	81.90	83.60	84.97	86.65	88.02	91.06	93.17	82.59
	Girls.	898	74.45	75.85	77.70	79.28	80.58	81.65	82.70	84.57	85.78	88.20	89.72	81.08
Seventeen	Boys.	79	73.75	78.90	81.83	83.45	84.77	86.08	87.28	88.61	90.30	93.28	94.85	85.18
	Girls.	211	75.92	77.14	79.46	80.75	81.92	83.18	84.25	85.84	87.07	89.49	91.29	82.77
Eighteen	Boys.	81	78.10	84.05	86.20	88.10	89.10	89.88	90.52	91.70	92.70	93.95	95.45	88.65
	Girls.	164	76.04	77.85	79.34	80.65	82.17	83.27	84.39	85.78	87.02	89.12	90.86	82.79
Nineteen	Girls.	82	77.02	78.05	80.04	81.00	81.78	83.20	84.08	85.06	87.12	88.95	89.98	82.30
Twenty	Girls.	65	78.75	80.12	82.00	83.25	84.88	85.79	86.88	87.50	89.00	89.81	91.75	84.99
Twenty-one	Girls.	82	80.60	81.40	82.70	84.20	85.26	86.38	87.40	89.20	90.40	91.40	92.40	86.97

TABLE No. 22.

The Girth of Chest at Full Expiration.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	Boys.	679	52.00	54.06	55.12	56.09	56.92	57.60	58.85	59.24	60.12	61.85	64.20	57.26
	Girls.	743	52.36	53.46	54.97	55.90	56.91	57.48	58.28	59.15	60.28	61.84	63.64	57.00
Seven	Boys.	1715	54.09	55.10	56.86	57.28	58.15	58.92	59.77	60.65	61.88	63.74	65.55	58.68
	Girls.	1659	52.00	53.96	55.41	56.48	57.40	58.31	59.11	60.06	61.27	62.97	64.64	57.80
Eight	Boys.	2076	54.92	56.27	57.86	58.85	59.74	60.64	61.54	62.45	63.54	65.09	66.48	60.08
	Girls.	2036	54.06	55.05	56.53	57.62	58.53	59.49	60.47	61.44	62.63	64.28	65.60	59.01
Nine	Boys.	2121	56.66	57.79	59.24	60.87	61.29	62.15	63.06	64.21	65.44	67.18	68.91	61.78
	Girls.	1967	55.35	56.62	58.24	59.32	60.26	61.20	62.16	63.26	64.43	66.25	67.82	60.72
Ten	Boys.	1993	57.90	59.13	60.57	61.59	62.54	63.54	64.57	65.70	67.16	69.49	71.25	63.82
	Girls.	1894	56.33	57.71	59.34	60.55	61.51	62.47	63.48	64.61	65.92	67.79	69.92	62.07
Eleven	Boys.	1732	58.92	60.37	61.87	63.82	64.19	65.20	66.10	67.24	68.78	70.79	72.00	64.80
	Girls.	1664	57.66	58.92	60.52	61.93	63.12	64.28	65.43	66.65	67.75	69.98	71.90	63 80
Twelve..... .	Boys.	1561	60.14	61.45	63.15	64.89	65.44	66.50	67.60	68.72	70.22	71.94	73.57	66.10
	Girls.	1619	59.36	61.02	62.88	64.01	65.21	66.38	67.75	69.27	70.98	73.16	75.19	66.26
Thirteen	Boys.	1215	61.52	62.78	64.46	65.82	67.14	68.33	69.48	70.58	72.00	74.51	76.28	67.92
	Girls.	1311	61.11	63.12	65.38	66.87	68.26	69.64	70.86	72.26	73.95	76.51	78.77	69.24
Fourteen	Boys.	929	63.24	64.55	66.64	67.98	69.16	70.32	71.76	73.47	75.22	77.59	79.80	70.33
	Girls.	1018	64.22	65.60	67.90	69.78	70.91	72.36	73.77	75.20	76.85	79.43	82.00	71.88
Fifteen.......	Boys.	499	65.33	67.15	69.35	70.84	72.34	73.89	74.95	76.44	78.36	80.95	83.65	73.37
	Girls.	657	66.20	68.39	70.67	72.13	73.26	74.78	76.30	77.94	80.10	82.38	84.65	74.61
Sixteen	Boys.	204	67.04	68.90	71.31	73.88	75.00	76.21	77.67	79.25	80.92	84.23	87.12	75.86
	Girls.	395	69.41	70.68	72.61	74.34	75.59	76.78	78.18	79.52	81.54	84.77	87.05	76.62
Seventeen	Boys.	80	68.00	72.33	74.33	76.00	77.44	78.33	79.38	81.50	82.67	84.00	86.00	77.61
	Girls.	201	70.68	72.51	74.16	75.74	76.98	78.27	79.76	81.12	83.00	85.36	88.00	78.01
Eighteen	Boys.	31	74.10	75.55	77.20	79.26	79.88	80.83	82.20	83.18	83.95	86.90	87.48	80.39
	Girls.	160	71.17	73.00	74.64	76.10	77.47	78.57	79.62	81.08	82.71	84.88	86.67	78.12
Nineteen	Girls.	81	68.50	70.35	71.84	73.55	74.60	76.42	77.77	78.96	80.23	82.45	85.48	75.91
Twenty	Girls.	67	70.07	70.74	73.13	74.41	75.20	76.50	77.64	79.32	80.15	82.38	82.94	76.09
Twenty-one ..	Girls.	32		70.20	73.20	74.40	75.40	76.66	77.78	79.70	80.65	84.40	86.20	76.06

TABLE No. 21.

THE GIRTH OF CHEST AT FULL INSPIRATION.

Age at Nearest Birthday.	SEX.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	**Boys.**	**674**	**56.05**	**57.13**	**58.72**	**59.87**	**60.36**	**61.04**	**61.78**	**62.59**	**63.75**	**65.59**	**67.04**	**60.84**
	Girls.	739	54.77	56.41	57.52	58.64	59.51	60.26	60.92	61.69	62.81	64.42	66.04	59.68
Seven	**Boys.**	**1702**	**57.74**	**58.98**	**60.26**	**61.25**	**62.47**	**62.86**	**63.70**	**64.69**	**65.82**	**67.45**	**69.87**	**62.56**
	Girls.	1603	55.99	57.26	58.75	59.96	60.75	61.43	62.39	63.34	64.55	66.14	67.68	61.15
Eight	**Boys.**	**2114**	**59.32**	**60.57**	**62.14**	**63.10**	**64.00**	**64.46**	**65.76**	**66.70**	**67.78**	**69.21**	**70.28**	**64.29**
	Girls.	2044	57.80	58.91	60.28	61.32	62.27	63.19	64.18	65.03	66.10	67.69	68.79	62.62
Nine	**Boys.**	**2118**	**61.33**	**62.18**	**63.61**	**64.68**	**65.64**	**66.51**	**67.41**	**68.42**	**69.59**	**71.16**	**72.49**	**66.02**
	Girls.	1964	59.87	60.33	61.95	63.10	64.06	64.87	65.73	66.80	67.89	69.52	71.00	64.31
Ten	**Boys.**	**2000**	**62.33**	**63.68**	**65.20**	**66.60**	**67.40**	**68.31**	**69.23**	**70.23**	**71.46**	**73.41**	**75.30**	**67.87**
	Girls.	1891	59.86	60.26	61.85	63.00	63.93	66.46	67.41	68.46	69.67	71.15	72.81	65.97
Eleven	**Boys.**	**1732**	**64.03**	**65.32**	**67.13**	**68.33**	**69.28**	**70.16**	**70.92**	**71.97**	**73.36**	**75.44**	**77.25**	**69.69**
	Girls.	1643	62.35	63.26	64.91	66.16	67.38	68.45	69.61	70.48	71.61	73.84	75.81	67.90
Twelve.......	**Boys.**	**1568**	**65.44**	**66.86**	**68.66**	**69.93**	**70.91**	**71.84**	**72.97**	**73.99**	**75.32**	**77.30**	**78.96**	**71.43**
	Girls.	1628	63.64	65.31	67.29	68.50	69.55	70.61	71.77	73.11	74.81	77.14	79.23	70.42
Thirteen	**Boys.**	**1240**	**66.38**	**68.20**	**70.73**	**71.34**	**72.59**	**73.70**	**74.88**	**76.17**	**77.76**	**79.95**	**82.00**	**73.31**
	Girls.	1315	65.39	67.53	69.85	71.20	72.37	73.65	74.93	76.34	77.96	80.62	82.84	73.35
Fourteen	**Boys.**	**920**	**69.21**	**70.60**	**72.43**	**73.90**	**75.25**	**76.44**	**77.95**	**79.32**	**80.96**	**83.58**	**85.74**	**76.21**
	Girls.	1021	68.44	70.33	72.46	73.98	75.48	76.82	78.34	79.77	81.34	83.61	85 68	76.39
Fifteen.......	**Boys.**	**497**	**71.55**	**73.43**	**75.68**	**77.12**	**78.62**	**79.99**	**81.58**	**83.27**	**85.23**	**87.71**	**89.57**	**79.75**
	Girls.	660	71.19	73.08	75.17	76.69	78.26	79.07	80.64	82.71	83.84	85.87	88.25	78.95
Sixteen	**Boys.**	**206**	**72.10**	**74.65**	**78.02**	**79.75**	**81.90**	**83.60**	**84.97**	**86.65**	**88.02**	**91.06**	**93.17**	**82.59**
	Girls.	398	74.45	75.85	77.70	79.28	80.58	81.65	82.70	84.57	85.78	88.20	89.72	81.08
Seventeen	**Boys.**	**79**	**73.75**	**78.90**	**81.83**	**83.45**	**84.77**	**86.08**	**87.28**	**88.61**	**90.80**	**93.28**	**94.85**	**85.18**
	Girls.	211	75.92	77.14	79.46	80.75	81.92	83.18	84.25	85.34	87.07	89.49	91.29	82.77
Eighteen	**Boys.**	**31**	**78.10**	**84.05**	**86.20**	**88.10**	**89.10**	**89.88**	**90.52**	**91.70**	**92.70**	**93.95**	**95.45**	**88.65**
	Girls.	164	76.04	77.85	79.34	80.65	82.17	83.27	84.39	85.78	87.02	89.12	90.36	82.79
Nineteen	Girls.	82	77.02	78.05	80.04	81.00	81.73	83.20	84.08	85.06	87.12	88.95	89.98	82.80
Twenty	Girls.	65	78.75	80.12	82.00	83.25	84.83	85.79	86.88	87.50	89.00	89.81	91.75	84.99
Twenty-one ..	Girls.	82	80.60	81.40	82.70	84.20	85.26	86.33	87.40	89.20	90.40	91.40	92.40	86.97

TABLE No. 22.

THE GIRTH OF CHEST AT FULL EXPIRATION.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	**Boys.** Girls.	**679** 743	**52.00** 52.36	**54.06** 53.46	**55.12** 54.97	**56.09** 55.90	**56.92** 56.91	**57.60** 57.48	**58.35** 58.28	**59.24** 59.15	**60.12** 60.28	**61.85** 61.84	**64.20** 63.64	**57.26** 57.00
Seven	**Boys.** Girls.	**1715** 1659	**54.09** 52.00	**55.10** 53.96	**56.36** 55.41	**57.28** 56.48	**58.15** 57.40	**58.92** 58.31	**59.77** 59.11	**60.65** 60.06	**61.88** 61.27	**63.74** 62.97	**65.55** 64.64	**58.68** 57.80
Eight	**Boys.** Girls.	**2076** 2036	**54.92** 54.06	**56.27** 55.05	**57.86** 56.53	**58.85** 57.62	**59.74** 58.53	**60.64** 59.49	**61.54** 60.47	**62.45** 61.44	**63.54** 62.63	**65.09** 64.28	**66.48** 65.60	**60.08** 59.01
Nine	**Boys.** Girls.	**2121** 1967	**56.66** 55.35	**57.79** 56.62	**59.24** 58.24	**60.37** 59.32	**61.29** 60.26	**62.15** 61.20	**63.06** 62.16	**64.21** 63.26	**65.44** 64.43	**67.18** 66.25	**68.91** 67.82	**61.78** 60.72
Ten	**Boys.** Girls.	**1993** 1894	**57.90** 56.33	**59.18** 57.71	**60.57** 59.34	**61.59** 60.55	**62.54** 61.51	**63.54** 62.47	**64.57** 63.48	**65.70** 64.61	**67.16** 65.92	**69.49** 67.79	**71.25** 69.92	**63.32** 62.07
Eleven	**Boys.** Girls.	**1732** 1664	**58.92** 57.66	**60.37** 58.92	**61.87** 60.52	**63.82** 61.93	**64.19** 63.12	**65.20** 64.28	**66.10** 65.43	**67.24** 66.65	**68.78** 67.75	**70.79** 69.98	**72.00** 71.90	**64.80** 63 80
Twelve	**Boys.** Girls.	**1561** 1619	**60.14** 59.36	**61.45** 61.02	**63.15** 62.88	**64.89** 64.01	**65.44** 65.21	**66.50** 66.38	**67.60** 67.75	**68.72** 69.27	**70.22** 70.98	**71.94** 73.16	**73.57** 75.19	**66.10** 66.26
Thirteen	**Boys.** Girls.	**1215** 1311	**61.52** 61.11	**62.78** 63.12	**64.46** 65.38	**65.82** 66.87	**67.14** 68.26	**68.33** 69.64	**69.48** 70.86	**70.58** 72.26	**72.00** 73.95	**74.51** 76.51	**76.28** 78.77	**67.92** 69.24
Fourteen	**Boys.** Girls.	**929** 1018	**63.24** 64.22	**64.55** 65.60	**66.64** 67.90	**67.98** 69.78	**69.16** 70.91	**70.82** 72.36	**71.76** 73.77	**73.47** 75 20	**75.22** 76.85	**77.59** 79.43	**79.80** 82.00	**70.33** 71.88
Fifteen	**Boys.** Girls.	**499** 657	**65.33** 66.20	**67.15** 68.39	**69.35** 70.67	**70.84** 72.13	**72.34** 73.26	**73.89** 74.78	**74.95** 76.30	**76.44** 77.94	**78.36** 80.10	**80.95** 82.38	**83.65** 84.65	**73.87** 74.61
Sixteen	**Boys.** Girls.	**204** 395	**67.04** 69.41	**68.90** 70.68	**71.31** 72.61	**73.88** 74.34	**75.00** 75.59	**76.21** 76.78	**77.67** 78.18	**79.25** 79.52	**80.92** 81.54	**84.23** 84.77	**87.12** 87.05	**75.86** 76.62
Seventeen	**Boys.** Girls.	**80** 201	**68.00** 70.68	**72.33** 72.51	**74.33** 74.16	**76.00** 75.74	**77.44** 76.98	**78.33** 78.27	**79.33** 79.76	**81.50** 81.12	**82.67** 83.00	**84.00** 85.36	**86.00** 88.00	**77.61** 78.01
Eighteen	**Boys.** Girls.	**31** 160	**74.10** 71.17	**75.55** 73.00	**77.20** 74.64	**79.26** 76.10	**79.88** 77.47	**80.83** 78.57	**82.20** 79.62	**83.18** 81.08	**83.95** 82.71	**86.90** 84.88	**87.48** 86.67	**80.39** 78.12
Nineteen	Girls.	81	68.50	70.35	71.84	73.55	74.60	76.42	77.77	78.96	80.23	82.45	85.48	75.91
Twenty	Girls.	67	70.07	70.74	73.13	74.41	75.20	76.50	77.64	79.32	80.15	82.38	82.94	76.09
Twenty-one	Girls.	32		70.20	73.20	74.40	75.40	76.66	77.73	79.70	80.65	84.40	86.20	76.06

TABLE No. 23.

THE GIRTH OF CHEST MIDWAY BETWEEN FULL INSPIRATION AND FULL EXPIRATION.*

Age at nearest Birthday.	Sex.	Number of Observations.	Value of Centimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six	Boys.	677	54.02	55.59	56.92	57.98	58.64	59.82	60.04	60.91	61.98	63.72	65.62	59.95
	Girls.	741	53.56	54.93	56.34	57.27	58.21	58.87	59.60	60.42	61.54	63.13	64.84	58.34
Seven	Boys.	1708	55.91	57.04	58.31	59.26	60.81	60.89	61.78	62.67	63.82	65.59	67.46	60.62
	Girls.	1631	53.99	55.61	57.08	58.22	59.07	59.87	60.75	61.70	62.91	64.55	66.16	59.47
Eight	Boys.	2095	57.12	58.42	60.00	60.97	61.87	62.55	63.65	64.62	65.63	67.15	68.33	62.18
	Girls.	2040	55 93	56 98	58.40	59.47	60.40	61.34	62.32	63.23	64.36	65.98	67.19	60.81
Nine	Boys.	2120	58.99	59.98	61.42	62.52	63.46	64.33	65.23	66.31	67.51	69.17	70.80	63.90
	Girls.	1966	57.61	58.47	60.09	61.21	62.16	63.03	63.94	65.03	66.16	67.88	69.41	62.51
Ten	Boys.	1997	60.11	61.40	62.88	64.09	64.97	65.92	66.90	67.96	69.31	71.45	73.27	65.59
	Girls.	1893	57.84	58.98	60.59	61.77	62.72	64.46	65.44	66.53	67.79	69.47	71.36	63 02
Eleven	Boys.	1732	61.47	62.84	64.50	66.07	66.73	67.68	68.51	69.60	71.04	73.11	74.62	67.24
	Girls.	1654	60.00	61.09	62.71	64.05	65.25	66.36	67.52	68.56	69.68	71.91	73.85	65.85
Twelve	Boys.	1565	62.79	64.15	65.90	67.16	68.17	69.17	70.28	71.35	72.77	74.62	76.26	68.76
	Girls.	1624	61.50	63.16	65.08	66.25	67.38	68.49	69.76	71.19	72.89	75.15	77.21	68.34
Thirteen	Boys.	1228	63.95	65.49	67.59	68.58	69.86	71.01	72.16	73.87	74.88	77.23	79.14	70.61
	Girls.	1313	63.25	65.32	67.61	69.03	70.31	71.64	72.89	74.30	75.95	78.56	80.80	71.29
Fourteen	Boys.	925	66.22	67.57	69.53	70.94	72.20	73.38	74.85	76.44	78.09	80.56	82.77	73.27
	Girls.	1020	66.33	67.96	70.18	71.88	73.19	74.59	76.05	77.48	79.09	81.52	83.84	74.18
Fifteen	Boys.	498	68.44	70.29	72.51	73.98	75.48	76.94	78.26	79.85	81.79	84.88	86.60	76.56
	Girls.	659	68.69	70.73	72.92	74.41	75.76	76.92	78.47	80.32	81.97	84.12	86.45	76.78
Sixteen	Boys.	205	69.57	71.77	74.66	76.56	78.45	79.90	81.82	82.95	84.47	87.64	90.14	79.22
	Girls.	397	71.93	73.26	75.15	76.81	78.08	79.22	80.44	82.04	83.66	86.48	88.88	78.85
Seventeen	Boys.	80	70.87	75.61	78.08	79.72	81.10	82.20	83.28	85.05	86.48	88.64	90.17	81.89
	Girls.	206	73.30	74.82	76.81	78.24	79.45	80.72	82.00	83.28	85.03	87.42	89.64	80.39
Eighteen	Boys.	31	76.10	79.80	81.70	83.68	84.49	85.85	86.86	87.44	88.82	90.42	91.46	84.52
	Girls.	162	73.60	75.42	76.99	78.37	79.82	80.92	82.00	84.93	84.86	87.00	88.51	80.45
Nineteen	Girls.	82	72.76	74.20	75.94	77.27	78.16	79.81	80.90	82.01	83.67	85.70	87.73	79.10
Twenty	Girls.	66	74.41	75.43	77.56	78.83	80.01	81.04	82.28	83.41	84.57	86.09	87.34	80.54
Twenty-one	Girls.	32		75.80	77.95	79.80	80.33	81.49	82.56	84.45	85.52	87.90	89.30	81.51

* Obtained by adding the Girth of Chest at Full Inspiration to the Girth of Chest at Full Expiration and dividing the sum by 2.

TABLE No. 24.

THE LENGTH OF HEAD.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Millimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Millimetr's
Six..........	**Boys.**	**606**	**169.19**	**170.83**	**173.50**	**175.75**	**177.34**	**178.86**	**180.39**	**181.50**	**184.08**	**186.95**	**189.23**	**178.39**
	Girls.	606	163.69	166.42	169.44	170.94	172.89	174.34	175.80	177.40	178.87	180.98	183.93	173.45
Seven	**Boys.**	**1493**	**168.59**	**170.99**	**173.87**	**175.80**	**177.85**	**179.92**	**181.02**	**182.71**	**184.86**	**187.34**	**190.03**	**178.54**
	Girls.	1511	165.13	167.37	170.48	172.34	174.08	175.58	177.14	178.79	180.73	183.25	185.44	174.09
Eight.........	**Boys.**	**2079**	**170.03**	**171.89**	**175.14**	**176.91**	**178.80**	**180.44**	**182.03**	**183.92**	**185.81**	**188.73**	**190.86**	**179.62**
	Girls.	2125	165.55	168.42	171.07	173.26	175.25	176.41	178.17	180.15	181.48	184.18	185.90	175.18
Nine..........	**Boys.**	**1986**	**170.01**	**172.39**	**175.62**	**177.79**	**179.84**	**181.00**	**182.77**	**184.80**	**186.59**	**190.04**	**191.67**	**180.72**
	Girls.	1884	166.58	169.93	172.61	174.77	176.08	177.80	179.54	180.76	182.59	185.55	187.53	176.39
Ten	**Boys.**	**1912**	**171.50**	**174.37**	**177.09**	**179.10**	**180.20**	**181.51**	**183.22**	**184.99**	**186.70**	**189.85**	**191.82**	**181.45**
	Girls.	1790	167.72	170.45	173.03	175.26	176.77	178.52	180.10	181.26	183.67	185.99	188.11	177.24
Eleven	**Boys.**	**1654**	**172.66**	**175.00**	**177.70**	**179.99**	**181.38**	**182.86**	**184.62**	**186.17**	**188.34**	**190.93**	**193.38**	**182.37**
	Girls.	1560	167.47	170.73	173.69	175.73	177.82	179.75	181.00	182.71	184.84	187.45	190.35	178.08
Twelve	**Boys.**	**1576**	**172.79**	**175.22**	**178.05**	**180.32**	**181.76**	**183.08**	**184.78**	**186.41**	**188.63**	**191.85**	**194.55**	**182.84**
	Girls.	1516	169.79	172.32	175.42	177.44	179.07	180.57	182.22	183.88	185.84	189.07	191.11	179.50
Thirteen......	**Boys.**	**1207**	**173.60**	**176.07**	**179.00**	**180.85**	**182.54**	**184.21**	**185.91**	**187.63**	**189.92**	**192.53**	**195.10**	**183.84**
	Girls.	1187	171.17	173.74	177.31	179.38	180.86	182.48	184.33	185.97	188.12	190.69	192.82	181.44
Fourteen	**Boys.**	**890**	**175.19**	**177.88**	**181.06**	**183.10**	**184.73**	**186.24**	**187.95**	**189.60**	**191.89**	**195.00**	**196.79**	**186.93**
	Girls.	1008	173.03	175.93	179.05	181.09	182.87	184.71	186.02	187.55	189.90	192.68	195.08	183.41
Fifteen.......	**Boys.**	**502**	**176.67**	**178.98**	**182.18**	**183.84**	**185.73**	**187.69**	**190.00**	**191.00**	**192.94**	**196.26**	**199.09**	**187.01**
	Girls.	649	174.49	177.46	180.59	182.47	184.33	185.67	187.67	189.46	191.34	194.32	195.98	185.12
Sixteen.......	**Boys.**	**191**	**178.83**	**180.48**	**183.88**	**185.74**	**188.21**	**190.04**	**191.56**	**194.01**	**195.58**	**198.48**	**200.73**	**189.06**
	Girls.	400	175.80	179.00	181.82	184.21	186.00	187.70	189.50	191.40	193.54	196.08	198.00	186.84
Seventeen	Girls.	221	179.02	181.03	183.62	185.53	187.18	188.60	190.03	191.34	193.85	197.38	199.59	188.14
Eighteen	Girls.	161	179.36	181.22	184.12	185.46	187.11	188.41	190.04	190.98	192.73	195.99	198.98	187.97
Nineteen......	Girls.	77	180.70	181.85	183.80	184.92	185.97	188 31	189.30	190.70	192.80	195.65	199.06	187.91

TABLE No. 25.

The Width of Head.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Millimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Millimetr's
Six	**Boys.**	**573**	**134.70**	**138.01**	**140.08**	**141.45**	**142.73**	**143.76**	**145.11**	**146.20**	**148.01**	**150.60**	**152.72**	**143.29**
	Girls.	609	131.74	133.93	136.25	138.17	139.91	140.83	142.31	143.64	145.44	147.93	150.25	140.27
Seven	**Boys.**	**1571**	**136.31**	**138.87**	**140.80**	**142.33**	**143.46**	**144.98**	**145.93**	**147.25**	**149.26**	**151.51**	**153.54**	**144.37**
	Girls.	1505	133.66	135.56	137.64	139.61	140.80	142.10	143.25	144.74	146.13	148 78	150.70	141.40
Eight	**Boys.**	**1997**	**136.78**	**139.38**	**141.60**	**143.14**	**144.48**	**145.63**	**146.70**	**148.48**	**150.42**	**152.84**	**155.08**	**145.30**
	Girls.	1985	133.70	136.03	138.61	140.39	141.48	142.84	144.24	145.58	147.01	150.13	151.73	142.31
Nine	**Boys.**	**1962**	**137.44**	**140.04**	**141.97**	**143.62**	**145.07**	**146.08**	**147.44**	**149.20**	**150.89**	**153.56**	**155.49**	**145.87**
	Girls.	1914	134.82	136.80	139.88	141.05	142.40	143.58	144.96	146.01	148.01	150.61	152.68	143.04
Ten	**Boys.**	**1827**	**138.30**	**140.53**	**142.57**	**144.22**	**145.73**	**147.11**	**148.58**	**150.27**	**151.76**	**154.15**	**156.02**	**146.59**
	Girls.	1803	134.94	137.49	140.31	141.66	143.15	144 54	145.64	146.92	149.11	151.49	154.09	143.75
Eleven	**Boys.**	**1561**	**139.39**	**141.29**	**143.40**	**145.19**	**146.31**	**147.50**	**148.84**	**150.57**	**152.27**	**154.94**	**157.26**	**147.29**
	Girls.	1541	136.71	139.27	141.30	142.82	144.30	145.54	146.74	148.40	150.25	152.78	154.94	145.05
Twelve.......	**Boys.**	**1531**	**140.32**	**142.19**	**144.57**	**145.80**	**146.91**	**148.36**	**150.07**	**151.25**	**152.91**	**155.40**	**156.99**	**147.98**
	Girls.	1460	136.83	139.22	142.14	143.67	145.16	146.31	147.70	149.24	150.88	153.38	155.68	145.64
Thirteen	**Boys.**	**1175**	**140.41**	**142.32**	**144.88**	**146.08**	**147.48**	**149.01**	**150.68**	**152.10**	**153.85**	**156.35**	**158.79**	**148.78**
	Girls.	1167	138.49	140.40	142.61	144.26	145.76	147.15	148.53	150.22	152.12	154.82	156.79	146.78
Fourteen	**Boys.**	**878**	**141.32**	**142.78**	**145.19**	**146.88**	**148.37**	**150.04**	**151.03**	**152.40**	**154.44**	**157.47**	**160.26**	**149.50**
	Girls.	927	139.57	141.47	143.68	145.46	146.83	148.25	149.71	151.14	153.13	155.88	157.98	147.90
Fifteen	**Boys.**	**469**	**140.83**	**143.06**	**145.46**	**147.02**	**148.68**	**150.41**	**151.88**	**153.27**	**154.80**	**156.96**	**159.79**	**149.63**
	Girls.	658	140.17	141.99	144.29	146.03	147.32	148.71	150.09	151.57	153.69	156.36	158.01	148.29
Sixteen	**Boys.**	**195**	**144.22**	**145.32**	**147.00**	**148.50**	**150.25**	**151.35**	**152.65**	**154.08**	**155.88**	**157.72**	**160.71**	**150.98**
	Girls.	395	140.39	142.28	145.00	146.69	148.39	149.67	150.89	152.48	154.89	156.53	159.05	148.95
Seventeen	**Boys.**	**75**	**142.75**	**146.50**	**148.48**	**151.25**	**151.00**	**152.50**	**153.57**	**155.50**	**157.60**	**159.75**	**165.25**	**152.09**
	Girls.	221	142.12	143.39	146.25	147.72	149.03	150.43	151.71	153.44	155.31	156.81	160.24	150.04
Eighteen	Girls.	165	141.42	142.81	145.27	146.65	148.46	150.16	151.28	152.50	153.91	156.62	158.69	149.09
Nineteen	Girls.	79	140.95	141.98	145.26	146.90	148.38	150.17	151.13	153.43	154.77	156.70	159.06	149.11
Twenty	Girls.	73	139.33	142.26	144.20	145.18	146.46	147.70	149.80	151.62	152.90	155.93	159.70	147.82

TABLE No. 26.

The Height of Face from Root of Nose to Point of Chin.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Millimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Millimetr's
Six..........	**Boys.**	**604**	**82.78**	**85.54**	**88.32**	**90.15**	**91.50**	**93.20**	**95.29**	**97.94**	**100.96**	**104.88**	**107.58**	**93.72**
	Girls.	612	82.14	83.62	85.98	87.87	89.15	90.89	93.14	95.22	97.69	100.96	105.05	91.42
Seven.......	**Boys.**	**1580**	**85.78**	**88.28**	**90.44**	**92.12**	**93.96**	**95.57**	**97.89**	**99.86**	**102.86**	**105.88**	**109.78**	**95.87**
	Girls.	1509	83.26	85.68	88.28	90.41	91.76	93.20	95.17	96.97	99.78	103.49	106.63	93.77
Eight.........	**Boys.**	**2057**	**87.31**	**90.21**	**92.68**	**94.82**	**96.07**	**97.78**	**99.81**	**101.28**	**104.14**	**107.72**	**110.65**	**97.98**
	Girls.	2016	86.22	88.34	90.78	92.56	94.24	95.60	97.15	98.97	101.61	105.49	108.77	95.65
Nine..........	**Boys.**	**2011**	**90.06**	**91.48**	**94.14**	**95.93**	**97.60**	**99.42**	**100.77**	**103.03**	**105.46**	**109.89**	**112.35**	**99.51**
	Girls.	1898	88.60	90.42	92.63	94.59	95.97	97.60	99.43	101.04	103.58	107.42	111.22	97.85
Ten..........	**Boys.**	**1868**	**91.19**	**93.32**	**95.74**	**97.58**	**99.14**	**100.78**	**102.95**	**104.87**	**106.99**	**110.72**	**113.16**	**101.06**
	Girls.	1820	90.04	91.72	94.18	95.89	97.53	99.02	100.94	103.00	105.44	109.72	112.17	99.39
Eleven..... ..	**Boys.**	**1660**	**92.52**	**94.94**	**97.52**	**99.54**	**100.96**	**103.28**	**105.16**	**107.85**	**110.85**	**113.90**	**117.05**	**103.87**
	Girls.	1572	91.94	93.79	96.16	98.00	99.75	101.20	102.87	104.97	107.67	111.10	114.60	101.44
Twelve.......	**Boys.**	**1568**	**94.74**	**96.59**	**98.96**	**100.80**	**102.43**	**104.45**	**105.97**	**108.71**	**110.88**	**115.47**	**120.08**	**104.25**
	Girls.	1523	91.76	94.52	97.68	99.94	101.92	103.53	105.23	107.30	110.36	113.53	117.38	103.46
Thirteen......	**Boys.**	**1205**	**95.58**	**97.98**	**100.61**	**102.66**	**104.86**	**106.34**	**108.71**	**110.61**	**112.91**	**116.66**	**120.70**	**106.24**
	Girls.	1231	95.70	98.15	100.66	102 54	104.21	105.71	107.85	110.19	112 21	115.60	118.59	105.92
Fourteen.....	**Boys.**	**893**	**96.55**	**99.70**	**102.51**	**104.77**	**106.17**	**108.51**	**110.40**	**112.35**	**115.28**	**119.43**	**123.04**	**108.43**
	Girls.	897	96.99	99.94	102.38	104.36	105.76	107.72	109.61	111.45	114.27	118.85	121.86	107.87
Fifteen.......	**Boys.**	**479**	**100.38**	**102.69**	**105.09**	**106.98**	**109.97**	**111.52**	**113.18**	**115.78**	**118.02**	**122.55**	**126.36**	**111.63**
	Girls.	672	98.24	100.68	103.31	105.80	108.07	109.40	110.96	112.75	115.34	120.24	122.74	109.79
Sixteen.......	**Boys.**	**191**	**103.31**	**105.02**	**107.89**	**110.48**	**112.49**	**113.78**	**115.62**	**117.43**	**120.52**	**123.73**	**126.96**	**113.63**
	Girls.	403	100.42	102.02	105.07	106.77	108.21	109.83	112.17	114.09	116.87	121.09	125.43	110.48
Seventeen....	**Boys.**	**78**	**102.45**	**105.80**	**111.04**	**113.80**	**116.80**	**118.50**	**120.47**	**121.58**	**124.20**	**130.40**	**135.10**	**117.56**
	Girls.	223	98.79	101.66	104.40	105.82	108.24	110.50	112.59	114.18	116.74	120.18	123.85	110.04
Eighteen.....	Girls.	163	100.23	101.72	104.94	106.36	108.42	110.04	112.32	112.84	115.27	119.34	122.85	109.77
Nineteen......	Girls.	80	101.00	102.17	103.75	105.60	106.75	108.84	110.20	111.80	114.00	117.00	121.00	108.72
Twenty.......	Girls.	78	102.16	103.08	105.53	107.15	109.17	110.30	111.63	112.85	115.40	120.18	121.35	110.26

TABLE No. 27.

THE WIDTH OF FACE.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Millimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Millimetr's
Six	**Boys.**	**608**	**105.64**	**110.25**	**112.85**	**115.23**	**116.77**	**118.20**	**119.64**	**120.74**	**122.50**	**125.44**	**127.78**	**117.24**
	Girls.	608	105.28	109.20	111.19	112.64	114.51	115.89	116.88	118.40	120.38	123.10	126.51	115.21
Seven	**Boys.**	**1637**	**108.08**	**110.88**	**113.48**	**115.88**	**116.68**	**118.40**	**119.98**	**121.04**	**122.89**	**125.59**	**128.88**	**117.78**
	Girls.	1516	107.65	110.25	112.15	113.75	115.21	116.38	117.80	119.57	120.87	123.86	126.09	116.11
Eight	**Boys.**	**2062**	**110.02**	**111.98**	**114.87**	**116.43**	**118.29**	**119.75**	**120.69**	**122.00**	**123.91**	**126.27**	**128.72**	**118.82**
	Girls.	2065	108.16	110.57	112.57	114.66	116.01	117.45	118.84	120.32	121.66	124.50	126.95	117.68
Nine	**Boys.**	**1927**	**110.05**	**112.10**	**115.49**	**117.59**	**119.70**	**120.75**	**122.14**	**123.67**	**125.51**	**128.08**	**130.62**	**119.91**
	Girls.	1905	108.20	110.62	113.55	115.63	117.17	118.81	120.24	121.36	122.99	125.59	127.88	118.02
Ten	**Boys.**	**1922**	**110.64**	**113.35**	**116.90**	**119.14**	**120.49**	**121.68**	**122.98**	**124.48**	**126.16**	**128.78**	**131.00**	**121.60**
	Girls.	1829	108.77	112.22	115.21	117.16	118.91	120.42	121.55	123.09	124.98	127.51	129.40	119.49
Eleven	**Boys.**	**1666**	**112.48**	**115.26**	**118.44**	**120.44**	**121.81**	**123.22**	**124.85**	**125.95**	**127.82**	**130.59**	**133.04**	**122.78**
	Girls.	1504	111.45	113.70	116.66	118.98	120.59	121.71	122.84	124.29	126.37	129.15	132.07	121.24
Twelve	**Boys.**	**1525**	**112.52**	**115.85**	**120.05**	**121.75**	**123.21**	**124.59**	**125.85**	**127.44**	**129.45**	**131.66**	**134.61**	**123.81**
	Girls.	1526	111.89	114.85	118.45	120.55	121.84	123.07	124.46	126.18	127.88	130.89	132.77	122.44
Thirteen	**Boys.**	**1218**	**114.96**	**118.24**	**120.96**	**122.95**	**124.63**	**126.02**	**127.88**	**128.92**	**130.65**	**133.19**	**136.40**	**125.88**
	Girls.	1248	113.10	116.40	119.71	121.53	123.38	124.86	126.28	127.87	129.76	132.35	134.78	124.15
Fourteen	**Boys.**	**898**	**116.53**	**120.18**	**122.04**	**124.80**	**125.78**	**127.82**	**128.98**	**130.63**	**132.65**	**135.89**	**137.51**	**126.81**
	Girls.	997	114.09	118.39	121.25	123.37	125.08	126.51	128.08	129.62	131.35	133.80	135.82	125.67
Fifteen	**Boys.**	**485**	**118.18**	**120.40**	**122.88**	**125.16**	**127.18**	**129.08**	**130.70**	**132.40**	**135.08**	**137.45**	**140.34**	**128.82**
	Girls.	678	118.57	120.75	123.63	125.39	126.86	128.30	129.66	131.08	132.96	135.88	138.41	127.85
Sixteen	**Boys.**	**193**	**120.88**	**123.29**	**125.40**	**127.88**	**129.22**	**130.82**	**132.70**	**134.01**	**135.77**	**138.78**	**140.91**	**130.27**
	Girls.	409	120.08	122.98	125.38	127.03	128.50	130.18	131.45	132.72	134.47	136.90	139.28	129.47
Seventeen	Girls.	219	122.19	123.99	126.76	128.05	130.04	131.88	132.55	134.22	135.78	138.28	140.03	130.68
Eighteen	**Girls.**	**163**	**124.08**	**125.41**	**128.07**	**130.21**	**130.92**	**131.97**	**133.24**	**134.34**	**135.84**	**138.30**	**139.98**	**131.42**

TABLE No. 28.

THE HEIGHT OF FACE FROM HAIR-LINE TO POINT OF CHIN.

Age at Nearest Birthday.	Sex.	Number of Observations.	Value in Millimetres at the following Percentile Grades.											Average.
			5	10	20	30	40	50	60	70	80	90	95	Millimetr's
Six...........	**Boys.**	**611**	**141.32**	**144.06**	**147.34**	**149.93**	**150.90**	**153.02**	**155.10**	**157.28**	**159.94**	**162.68**	**165.78**	**152.68**
	Girls.	609	137.55	140.46	143.49	145.87	147.74	150.45	152.61	155.01	157.40	161.34	164.51	150.16
Seven	**Boys.**	**1621**	**141.62**	**145.07**	**148.87**	**151.39**	**153.55**	**155.33**	**156.97**	**159.41**	**161.88**	**165.86**	**168.85**	**154.57**
	Girls.	1486	141.16	144.31	147.24	150.21	152.08	154.19	155.90	158.16	160.47	163.86	165.84	153.36
Eight.........	**Boys.**	**2012**	**144.88**	**148.35**	**151.75**	**154.32**	**156.10**	**158.04**	**160.20**	**161.72**	**164.48**	**168.86**	**170.86**	**157.50**
	Girls.	1965	143.38	146.14	150.03	152.07	153.89	155.60	157.45	160.08	162.13	165.61	168.76	155.19
Nine	**Boys.**	**1997**	**146.61**	**150.18**	**153.14**	**155.75**	**158.04**	**160.25**	**162.06**	**164.40**	**166.84**	**170.46**	**173.14**	**159.48**
	Girls.	1989	145.83	148.77	150.90	153.72	155.73	157.76	160.18	162.06	164.73	168.23	170.85	157.44
Ten	**Boys.**	**1909**	**148.67**	**151.85**	**155.35**	**157.59**	**160.27**	**161.70**	**163.71**	**165.89**	**168.86**	**172.25**	**175.25**	**161.87**
	Girls.	1835	147.07	150.37	154.28	156.43	158 49	160.56	162.57	164.90	167.40	170.85	174.37	160.04
Eleven	**Boys.**	**1653**	**150.47**	**153.75**	**157.29**	**160.04**	**162.05**	**164.11**	**165.72**	**168.10**	**170.80**	**174.94**	**177.72**	**163.39**
	Girls.	1581	149.29	152.43	156.32	158.44	161.09	163.40	165.35	168.89	170.17	173.13	176.08	162.55
Twelve.......	**Boys.**	**1577**	**152.30**	**155.49**	**159.36**	**161.38**	**163.51**	**165.62**	**167.55**	**170.41**	**172.67**	**176.39**	**180.16**	**165.23**
	Girls.	1510	151.83	155.14	158.77	161.77	163 45	165.95	168.41	170.34	172.46	176.61	180.06	165.29
Thirteen......	**Boys.**	**1211**	**154.68**	**157.30**	**161.24**	**163.94**	**165.94**	**168.16**	**170.31**	**172.33**	**175.40**	**178.74**	**181.49**	**167.62**
	Girls.	1220	154.62	158.00	162.00	164.35	166 38	169.15	171.32	173.62	176.08	179.96	182.64	168.35
Fourteen	**Boys.**	**896**	**155.98**	**158.90**	**163.66**	**166.35**	**168.65**	**171.04**	**173.56**	**175.98**	**178.86**	**182.59**	**185.95**	**170.49**
	Girls.	998	156.99	160.48	164.85	167.19	169.73	172.00	174.68	176.91	179.64	183.01	185.77	171.38
Fifteen	**Boys.**	**482**	**160.37**	**163.24**	**167.14**	**170.33**	**172.68**	**175.08**	**177.46**	**179.85**	**182.60**	**186.92**	**190.17**	**174.30**
	Girls.	656	161.98	164.56	167.28	170.55	172.78	174.85	176.63	178.86	181.34	185.03	187.72	174.20
Sixteen.......	**Boys.**	**193**	**165.22**	**168.38**	**171.66**	**173.86**	**175.75**	**177.98**	**180.36**	**183.01**	**185.42**	**191.23**	**194.68**	**178.19**
	Girls.	395	163.75	166.35	170.15	172.48	174.67	176.81	179.05	181.38	184.80	188.12	190.12	176.28
Seventeen	Girls.	201	162.03	167.41	172.31	174.90	177.17	179.41	180.07	183.59	186.20	190.38	194.48	
Eighteen	Girls.	139	167.48	170.22	174.95	177.68	180.33	181.93	183.57	185.55	188.07	192.03	195.02	
Nineteen.. ...	Girls	69	166.50	168.95	172.90	175.68	177.72	180.08	181.35	184.32	187.07	190.55	194.28	
Twenty.......	Girls.	72	169.30	171.60	174.08	175.52	177.16	179.00	181.07	182.88	185.87	188.90	192.20	

CHAPTER VI.

SEXUAL DIFFERENCES IN GROWTH.

When the curves of growth in weight, height standing, height sitting, span of arms and girth of chest are drawn on the same system of co-ordinates, as has been done in Plates XXV to XXIX inclusive, the attention of the observer is arrested by the extraordinary difference in the development of girls and boys during the period of prepubertal acceleration. Girls enter this time of rapid growth at age 11 or 12, two years earlier than boys, and during several years are larger than boys of the same age. The period during which girls are larger than boys does not correspond exactly with the period of accelerated development, but begins and ends a little later. The ages at which girls begin and cease to be larger than boys are given in the following table. The ages are nearly the same for the same percentile grade in all five dimensions. An examination of plates XXX to XXXVI

TABLE No. 29.

AGES AT WHICH GIRLS BEGIN AND CEASE TO BE LARGER THAN BOYS.

DIMENSION.	Age at which Girls begin to be larger than Boys.			Age at which Girls cease to be larger than Boys.		
	Percentile Grades.			Percentile Grades.		
	25	50	75	25	50	75
Weight..............	$12\frac{6}{12}$ yrs.	$12\frac{2}{12}$ yrs.	$11\frac{6}{12}$ yrs.	$16\frac{3}{12}$ yrs.	$15\frac{6}{12}$ yrs.	$14\frac{8}{12}$ yrs.
Height standing......	$11\frac{8}{12}$ “	$11\frac{5}{12}$ “	$11\frac{3}{12}$ “	$15\frac{8}{12}$ “	$15\frac{3}{12}$ “	$14\frac{6}{12}$ “
Height sitting.........	$11\frac{11}{12}$ “	$11\frac{6}{12}$ “	$11\frac{5}{12}$ “	$16\frac{11}{12}$ “	$16\frac{6}{12}$ “	$16\frac{2}{12}$ “
Span of arms.........	$12\frac{2}{12}$ “	$11\frac{11}{12}$ “	$11\frac{8}{12}$ “	$15\frac{3}{12}$ “	$14\frac{5}{12}$ “	$14\frac{2}{12}$ “
Girth of chest........	$12\frac{9}{12}$ “	$12\frac{6}{12}$ “	12 “	$16\frac{3}{12}$ “	15 “	$15\frac{5}{12}$ “
Height of face from hair line to point of chin...............		$11\frac{9}{12}$ yrs.			15 “	

shows that the sexual difference just noted is not present in expansion of chest, or in strength of squeeze, or in any head or face measurement except height of face from hair-line to point of chin. Boys have therefore a larger expansion of the chest, greater strength of squeeze and greater length and width of head and height and width of face than girls throughout their period of growth.

An interesting comparison can be made of the duration of the period in which girls are larger than boys. It appears that the period is shortest in span of arms and is considerably longer in height sitting than in any other dimension.

DURATION OF THE PERIOD DURING WHICH GIRLS ARE LARGER THAN BOYS.

DIMENSION.	Percentile Grades.		
	25	50	75
Weight	$3\frac{9}{12}$ yrs.	$3\frac{4}{12}$ yrs.	$3\frac{2}{12}$ yrs.
Height standing	4 "	$3\frac{10}{12}$ "	$3\frac{3}{12}$ "
Height sitting	5 "	5 "	$4\frac{9}{12}$ "
Span of arms	$3\frac{1}{12}$ "	$2\frac{6}{12}$ "	$2\frac{6}{12}$ "
Girth of chest	$3\frac{6}{12}$ "	$2\frac{6}{12}$ "	$3\frac{5}{12}$ "

The age at which girls begin to be larger than boys differs at different percentile grades, big girls (75 percentile grades) beginning to be larger than big boys at an earlier age than that at which small girls begin to exceed small boys. A difference is seen also in the duration of the period in which girls are larger than boys: the small girls keep their superiority during a longer time than the larger girls.

Sexual differences are further displayed in Plates XXXVII to XLI, inclusive, in which the percentile curves of both sexes are drawn one a short distance under the other, and the points at which girls begin and cease to be heavier than boys joined by heavy unbroken lines. The early superiority of large girls and the relative early loss of their superiority is seen in all the plates. The fact that the period during which big girls are larger than big boys is shorter than the period during which little girls are larger than little boys is very clearly demonstrated by Plates XXXVIII, Height Standing, XXXIX, Height Sitting and XL, Span of Arms; it can be seen also in Plate XXXVII, Weight, and XLI, Girth of Chest, if the ninety and the five percentile grades, in which the small number of observations has probably led to error, are neglected.

CHAPTER VII.

THE RATE OF GROWTH.

The Absolute Annual Increase is the gain in weight or height, etc., during the twelve preceding months; thus, the absolute annual increase in height at age 7 is the gain in weight during the twelve months from age 6 to age 7, obtained by subtracting the average or median weight at age 6 from that at age 7.

The absolute annual increase of height standing, weight and span of arms is shown in Plate XLII and Tables No. 30, 31 and 32. In all three, the maximum for girls is at age 13 and the maximum for boys at age 15. The same may be said of the curves for height sitting, girth of chest and strength of squeeze, in Plate XLIII, from Tables No. 33, 34, 44 and 45, although the curves are less regular, owing to the observations being more difficult than those from which the preceding plate was constructed. In all six curves, the small number of observations at age 17 and 18 cause the median values at those ages to be less reliable than at other ages.

The Relative Annual Increase is the increase for any year divided by the average value at that year; thus, the relative annual increase in weight at age 7 is the difference between the average weight at age 6 and age 7 divided by the average weight at age 6. The relative annual increase gives a truer idea of growth than the absolute annual increase, because the latter value is entangled with the size of the individual measured. The absolute increase is commonly greater in a big boy than in a small boy, and yet the rate of growth may be the same. The relative annual increase is free of such errors.

The relative annual increase in strength of squeeze, weight, height standing, height sitting, span of arms and girth of chest is drawn in Plate XLIV. The gain in weight during the prepubertal acceleration is extraordinary in both girls and boys, as is the rapid fall immediately thereafter. The quickness of growth in height standing of boys is slightly greater

TABLE No. 30.

THE ABSOLUTE ANNUAL INCREASE IN HEIGHT STANDING.

Age at nearest Birthday.	Sex.	Value in Centimetres at the following Percentile Grades.											Increase in average Height.
		5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six to Seven........	Boys.	3.90	4.06	4.98	5.08	5.07	5.25	5.41	5.27	5.39	5.48	5.07	5.08
	Girls.	4.73	4.83	4.96	5.00	5.11	5.34	5.63	5.71	5.84	5.38	5.04	5.28
Seven to Eight......	Boys.	4.01	4.72	4.92	5.20	5.47	5.30	5.42	5.59	5.54	5.49	5.66	5.10
	Girls.	5.25	5.62	5.39	5.31	5.51	5.31	5.13	5.10	5.45	5.41	5.85	5.41
Eight to Nine.......	Boys.	6.21	5.83	5.14	4.89	4.94	5.09	5.02	5.15	5.20	5.17	5.01	5.22
	Girls.	4.99	5.26	5.27	5.39	5.36	5.36	5.37	5.12	5.35	5.18	5.63	5.31
Nine to Ten	Boys.	4.15	3.81	4.29	4.50	4.60	4.58	4.78	4.67	4.89	5.24	5.39	4.52
	Girls.	4.26	4.22	4.55	4.56	4.56	4.74	4.80	5.28	4.71	5.89	5.42	4.76
Ten to Eleven	Boys.	4.49	4.67	4.53	4.55	4.77	4.99	4.87	4.70	4.80	5.04	5.30	4.97
	Girls.	3.52	4.07	4.02	4.52	4.76	4.75	4.92	5.05	5.73	5.30	5.85	4.76
Eleven to Twelve...	Boys.	4.12	4.00	4.15	4.28	4.12	4.18	4.56	4.70	4.72	4.84	5.08	4.37
	Girls.	5.11	5.25	5.37	5.39	5.47	5.94	6.18	6.42	6.52	7.00	7.50	5.92
Twelve to Thirteen .	Boys.	2.71	3.55	4.18	4.28	4.52	4.72	4.71	5.07	5.49	6.52	6.08	4.70
	Girls.	6.10	6.43	6.31	6.44	6.68	6.65	6.88	7.39	7.82	6.87	6.44	7.42
Thirteen to Fourteen	Boys.	5.74	5.49	4.91	5.05	5.21	5.57	5.55	6.25	6.28	5.64	6.97	5.67
	Girls.	4.86	4.57	5.84	5.89	6.02	5.75	5.44	4.69	4.86	4.28	3.86	4.31
Fourteen to Fifteen.	Boys.	3.84	4.06	5.20	5.70	6.15	6.39	6.80	6.93	7.76	8.81	7.56	6.32
	Girls.	6.09	6.54	5.14	4.67	4.08	3.88	3.19	3.23	3.29	2.46	2.84	4.20
Fifteen to Sixteen ..	Boys.	5.48	5.69	6.43	6.36	6.80	6.02	5.61	5.28	5.07	3.02	3.11	5.37
	Girls.	3.89	2.25	2.23	2.14	2.24	2.21	2.65	2.37	2.10	3.16	2.81	2.48
Sixteen to Seventeen	Boys.	8.48	7.52	5.79	5.28	4.75	4.78	5.05	4.78	3.88	4.05	3.50	4.86
	Girls.	1.43	2.01	1.68	1.75	1.25	1.37	1.00	1.05	1.18	0.80	0.82	1.81
Seventeen to Eighteen	Boys.						4.50						5.28
	Girls.	0.67	1.01	1.00	0.56	0.77	0.10	0.08	0.24	0.48	0.22	1.14	0.09

TABLE No. 31.

The Absolute Annual Increase in Weight.

Age at Nearest Birthday.	Sex.	Value in Kilogrammes at the following Percentile Grades.											Increase of Average.
		5	10	20	30	40	50	60	70	80	90	95	Kilograms.
Six to Seven........	Boys.	**1.66**	**1.48**	**1.46**	**1.67**	**1.68**	**1.81**	**1.92**	**2.09**	**2.09**	**2.45**	**2.72**	**1.92**
	Girls.	1.16	1.35	1.49	1.61	1.79	1.82	1.90	2.10	2.11	2.30	2.76	1.89
Seven to Eight......	Boys.	**1.32**	**1.59**	**1.88**	**1.90**	**2.07**	**2.21**	**2.36**	**2.45**	**2.54**	**2.68**	**2.65**	**2.11**
	Girls.	1.67	1.66	1.76	1.78	1.93	2.04	2.21	2.18	2.33	2.72	2.63	2.06
Eight to Nine........	Boys.	**2.07**	**2.21**	**2.15**	**2.19**	**2.20**	**2.35**	**2.38**	**2.42**	**2.48**	**2.26**	**3.04**	**2.28**
	Girls.	1.62	1.79	2.01	2.09	2.08	2.19	2.22	2.46	2.56	2.52	2.86	2.20
Nine to Ten.	Boys.	**1.41**	**1.54**	**1.82**	**1.98**	**2.28**	**2.14**	**2.41**	**2.41**	**2.65**	**3.03**	**2.57**	**2.26**
	Girls.	1.48	1.78	1.84	2.17	2.32	2.41	2.46	2.56	2.73	2.69	2.92	2.41
Ten to Eleven.......	Boys.	**2.34**	**2.16**	**2.32**	**2.54**	**2.50**	**2.72**	**2.67**	**2.77**	**2.98**	**2.96**	**3.21**	**2.68**
	Girls.	1.95	2.08	2.29	2.12	2.29	2.35	2.66	2.79	2.98	4.08	4.19	2.66
Eleven to Twelve ...	Boys.	**2.16**	**2.22**	**2.16**	**2.14**	**2.40**	**2.88**	**2.38**	**2.68**	**2.58**	**3.07**	**3.46**	**2.51**
	Girls.	2.35	2.34	2.62	2.92	3.02	3.45	3.56	3.86	4.11	4.61	6.48	3.51
Twelve to Thirteen..	Boys.	**1.82**	**1.90**	**2.09**	**2.37**	**2.39**	**2.84**	**2.98**	**3.31**	**3.88**	**5.19**	**5.95**	**3.10**
	Girls.	2.96	3.18	3.65	3.97	4.37	4.75	5.31	5.82	6.10	6.51	5.47	4.83
Thirteen to Fourteen	Boys.	**2.78**	**3.20**	**3.56**	**3.49**	**3.68**	**3.78**	**4.61**	**5.08**	**6.37**	**5.92**	**6.58**	**3.88**
	Girls.	2.31	3.36	3.68	4.34	4.62	4.65	4.49	4.68	4.84	4.45	4.74	3.80
Fourteen to Fifteen..	Boys.	**3.74**	**3.88**	**3.82**	**3.94**	**4.67**	**5.51**	**5.78**	**6.19**	**6.55**	**6.79**	**6.88**	**5.78**
	Girls.	4.98	4.40	5.42	4.36	4.39	4.20	3.75	3.17	3.06	2.92	3.06	4.40
Fifteen to Sixteen...	Boys.	**1.96**	**2.82**	**5.58**	**5.72**	**6.34**	**6.34**	**6.67**	**6.71**	**5.66**	**6.76**	**6.87**	**5.88**
	Girls.	3.38	3.55	3.82	4.11	3.61	3.11	3.51	3.43	4.17	4.45	3.51	3.56
Sixteen to Seventeen	Boys.	**7.72**	**7.58**	**6.79**	**5.77**	**4.79**	**3.48**	**3.25**	**3.36**	**3.18**	**0.04**		**4.07**
	Girls.	4.41	3.57	2.15	2.08	2.43	2.56	2.72	2.53	1.48	0.84	1.66	2.36
Seventeen to Eighteen	Girls.	1.38	1.33	0.78	0.47	0.76	0.58	0.05	0.09	0.64	0.61	1.11	

TABLE No. 32.

THE ABSOLUTE ANNUAL INCREASE IN SPAN OF ARMS.

Age at Nearest Birthday.	Sex.	Value in Centimetres at the following Percentile Grades.											Increase of Average.
		5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six to Seven........	Boys.	**4.47**	**4.85**	**5.17**	**5.68**	**5.31**	**5.51**	**5.49**	**4.94**	**5.59**	**5.26**	**5.18**	**5.47**
	Girls.	4.71	4.85	4.73	4.32	4.77	6.15	5.93	6.21	5.52	5.49	5.69	5.40
Seven to Eight......	Boys.	**5.05**	**5.45**	**5.43**	**5.44**	**5.55**	**5.65**	**6.08**	**5.78**	**5.91**	**6.17**	**6.81**	**5.65**
	Girls.	5.38	6.64	6.19	5.80	5.95	5.02	5.68	5.31	5.20	6.15	6.14	5.97
Eight to Nine.......	Boys.	**5.48**	**5.43**	**5.10**	**4.96**	**5.01**	**4.94**	**4.98**	**5.83**	**5.10**	**5.41**	**5.96**	**5.11**
	Girls.	5.08	4.00	5.40	5.50	5.28	6.15	5.37	5.43	6.35	5.16	5.85	5.30
Nine to Ten.........	Boys.	**3.81**	**3.97**	**4.51**	**4.76**	**4.89**	**4.94**	**5.32**	**5.49**	**5.63**	**5.82**	**5.29**	**5.04**
	Girls.	4.64	4.82	4.44	4.52	4.73	4.90	5.02	5.17	5.48	6.85	6.14	5.12
Ten to Eleven.......	Boys.	**4.89**	**4.62**	**4.71**	**4.71**	**4.76**	**4.98**	**5.11**	**5.16**	**5.01**	**5.01**	**5.51**	**4.91**
	Girls.	4.54	4.60	4.59	4.99	5.31	5.38	5.40	5.63	5.84	6.11	6.11	5.49
Eleven to Twelve...	Boys.	**4.09**	**4.23**	**4.59**	**4.71**	**4.90**	**4.89**	**4.72**	**4.71**	**5.00**	**5.51**	**5.94**	**5.47**
	Girls.	4.67	5.07	5.68	5.71	5.98	6.04	6.33	6.57	6.58	6.40	7.36	5.83
Twelve to Thirteen..	Boys.	**3.78**	**4.35**	**4.24**	**4.82**	**4.59**	**4.85**	**5.18**	**5.70**	**6.19**	**6.78**	**6.48**	**4.49**
	Girls.	7.50	7.15	6.79	7.17	7.29	7.23	7.75	7.44	7.28	7.08	6.19	7.12
Thirteen to Fourteen	Boys.	**5.88**	**5.71**	**5.97**	**5.88**	**6.20**	**6.29**	**6.68**	**5.95**	**6.08**	**6.24**	**7.70**	**6.19**
	Girls.	4.65	5.43	6.12	6.29	5.96	5.73	5.11	5.20	5.11	3.98	4.15	5.39
Fourteen to Fifteen.	Boys.	**2.75**	**4.30**	**5.60**	**6.02**	**6.78**	**7.17**	**7.18**	**8.00**	**9.85**	**9.97**	**10.21**	**7.15**
	Girls.	6.08	5.56	4.48	4.15	3.48	2.65	3.16	3.05	2.69	3.17	3.54	3.80
Fifteen to Sixteen...	Boys.	**4.86**	**4.86**	**5.98**	**6.48**	**6.58**	**6.52**	**6.67**	**5.88**	**5.08**	**3.72**	**3.02**	**5.58**
	Girls.	2.45	2.07	3.06	2.49	2.29	3.10	2.28	1.83	1.87	1.84	1.91	2.13
Sixteen to Seventeen	Boys.	**8.68**	**9.28**	**7.36**	**6.09**	**5.01**	**4.27**	**2.92**	**4.22**	**3.56**	**3.36**	**2.95**	**4.60**
	Girls.	1.07	0.85	0.08		0.17	0.31	0.08	0.27	0.11			0.50
Seventeen to Eighteen	Boys.	**11.70**	**8.60**	**6.74**	**6.00**	**5.18**	**5.92**	**6.57**	**4.37**	**4.74**	**4.55**	**2.90**	**6.75**
	Girls.	1.10	1.28	1.11	1.47	2.17	1.76	1.77	1.99	1.98	1.97	1.63	1.46

TABLE No. 33.

The Absolute Annual Increase in Height Sitting.

Age at Nearest Birthday.	Sex.	Value in Centimetres at the following Percentile Grades.											Increase in Average Height Sitting.
		5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six to Seven........	Boys.	**2.13**	**2.00**	**2.01**	**2.10**	**2.25**	**2.45**	**2.46**	**2.35**	**2.05**	**2.07**	**0.61**	**2.01**
	Girls.	2.22	2.37	2.48	2.21	2.39	2.33	2.48	2.53	2.50	2.40	2.45	2.45
Seven to Eight......	Boys.	**1.80**	**1.88**	**1.98**	**2.14**	**2.10**	**1.99**	**1.89**	**1.92**	**1.99**	**1.63**	**1.13**	**1.42**
	Girls.	2.81	2.35	2.11	2.15	2.21	2.52	1.94	1.70	1.92	2.13	2.07	2.17
Eight to Nine.......	Boys.	**1.89**	**1.78**	**1.89**	**1.76**	**1.77**	**1.87**	**2.06**	**2.13**	**2.14**	**2.16**	**2.11**	**1.99**
	Girls.	1.57	1.99	1.99	2.16	1.99	1.23	2.30	2.51	2.36	2.28	2.54	2.19
Nine to Ten.........	Boys.	**1.60**	**2.33**	**1.76**	**1.95**	**2.08**	**2.10**	**2.05**	**2.02**	**2.07**	**2.29**	**0.36**	**2.52**
	Girls.	1.67	1.87	1.93	1.92	2.06	2.69	2.09	2.15	2.21	2.20	2.21	2.03
Ten to Eleven	Boys.	**1.53**	**1.13**	**1.94**	**1.82**	**1.86**	**1.91**	**1.86**	**1.86**	**1.89**	**1.77**	**3.84**	**1.42**
	Girls.	1.69	1.41	1.04	0.86	1.83	1.74	1.71	1.88	2.02	2.29	2.35	1.84
Eleven to Twelve...	Boys.	**2.39**	**1.73**	**1.79**	**1.62**	**1.61**	**1.59**	**1.72**	**1.80**	**1.81**	**1.77**	**2.18**	**1.88**
	Girls.	0.91	2.19	2.98	3.08	2.50	2.60	2.79	2.90	2.78	3.16	2.72	2.64
Twelve to Thirteen..	Boys.	**1.06**	**1.67**	**1.37**	**1.72**	**1.74**	**1.81**	**2.19**	**1.77**	**1.92**	**2.24**	**2.19**	**1.65**
	Girls.	3.93	2.98	2.94	3.24	3.07	3.30	3.43	3.21	4.12	3.82	4.39	3.36
Thirteen to Fourteen	Boys.	**1.81**	**1.76**	**2.31**	**2.36**	**2.25**	**2.22**	**2.09**	**2.76**	**3.23**	**3.61**	**4.37**	**2.64**
	Girls.	1.55	2.39	2.64	2.80	2.83	3.09	2.95	3.12	2.46	2.68	2.47	2.65
Fourteen to Fifteen..	Boys.	**2.17**	**2.50**	**2.08**	**2.20**	**2.58**	**2.96**	**3.24**	**3.67**	**4.04**	**3.73**	**3.14**	**2.90**
	Girls.	3.80	3.22	3.38	3.14	2.98	2.59	2.53	2.45	2.25	1.81	1.77	2.74
Fifteen to Sixteen ..	Boys.	**2.00**	**2.09**	**2.89**	**2.83**	**3.86**	**3.55**	**3.49**	**3.08**	**2.11**	**2.56**	**2.88**	**2.54**
	Girls.	3.59	3.72	2.50	2.31	2.27	2.30	2.22	1.96	1.91	1.56	1.85	2.34
Sixteen to Seventeen	Boys.	**3.18**	**3.47**	**3.74**	**4.22**	**3.42**	**3.00**	**3.46**	**3.32**	**3.14**	**3.18**	**2.68**	**3.40**
	Girls.	1.51	0.85	0.52	1.16	1.12	0.91	0.36	0.90	0.67	0.99	0.75	0.90
Seventeen to Eighteen	Boys.		**4.26**	**2.93**	**2.10**	**1.66**	**1.48**	**1.57**	**2.47**	**3.20**	**1.66**	**0.65**	**2.55**
	Girls.	1.03	0.82	1.59	0.93	0.71	0.48	0.81	0.28	0.24		0.55	0.54

TABLE No. 34.

The Absolute Annual Increase in the Girth of Chest; Derived from Table No. 23.

Age at Nearest Birthday.	Sex.	Value in Centimetres at the following Percentile Grades.											Increase of Average.
		5	10	20	30	40	50	60	70	80	90	95	Centimetr's
Six to Seven........	Boys.	**1.89**	**1.45**	**1.39**	**1.28**	**1.67**	**1.57**	**1.69**	**1.76**	**1.89**	**1.87**	**1.84**	**1.57**
	Girls.	0.48		0.74	0.95	0.86	1.00	1.15	1.28	1.37	1.42	1.32	1.18
Seven to Eight......	Boys.	**1.21**	**1.38**	**1.69**	**1.71**	**2.06**	**1.66**	**1.92**	**1.95**	**1.81**	**1.56**	**0.87**	**1.56**
	Girls.	2.94	1.27	1.32	1.25	1.33	1.47	1.57	1.53	1.45	1.43	1.08	1.34
Eight to Nine.......	Boys.	**1.87**	**1.56**	**1.42**	**1.55**	**1.09**	**1.78**	**1.58**	**1.69**	**1.88**	**2.02**	**2.47**	**1.72**
	Girls.	1.68	1.49	1.69	1.74	1.76	1.69	1.62	1.80	1.80	1.90	2.22	1.70
Nine to Ten.........	Boys.	**1.12**	**1.42**	**1.46**	**1.57**	**1.51**	**1.59**	**1.67**	**1.65**	**1.80**	**2.28**	**2.47**	**1.69**
	Girls.	0.23	0.51	0.50	0.56	0.56	1.48	1.50	1.50	1.63	1.59	1.95	0.51
Ten to Eleven.......	Boys.	**1.36**	**1.44**	**1.62**	**1.98**	**1.76**	**1.76**	**1.61**	**1.64**	**1.73**	**1.66**	**1.85**	**1.65**
	Girls.	2.16	2.11	2.12	2.28	2.53	1.90	2.08	2.03	1.89	2.44	2.49	2.38
Eleven to Twelve...	Boys.	**1.32**	**1.31**	**1.40**	**1.09**	**1.44**	**1.49**	**1.77**	**1.75**	**1.73**	**1.41**	**1.64**	**1.52**
	Girls.	1.50	2.07	2.37	2.20	2.13	2.13	2.24	2.68	3.21	3.24	3.36	2.49
Twelve to Thirteen.	Boys.	**1.16**	**1.34**	**1.69**	**1.42**	**1.69**	**1.84**	**1.88**	**1.92**	**2.11**	**2.61**	**2.88**	**1.85**
	Girls.	1.75	2.16	2.53	2.78	2.93	3.15	3.18	3.11	3.06	3.41	3.59	2.95
Thirteen to Fourteen	Boys.	**2.27**	**2.08**	**1.94**	**2.36**	**2.34**	**2.37**	**2.69**	**3.07**	**3.21**	**3.33**	**3.63**	**2.66**
	Girls.	3.08	2.64	2.57	2.85	2.88	2.95	3.16	3.18	3.14	2.96	3.04	2.84
Fourteen to Fifteen.	Boys.	**2.22**	**2.72**	**2.98**	**3.04**	**3.28**	**3.56**	**3.41**	**3.41**	**3.70**	**3.77**	**3.88**	**3.29**
	Girls.	2.36	2.77	2.74	2.53	2.57	2.33	2.42	2.84	2.88	2.60	2.61	2.65
Fifteen to Sixteen...	Boys.	**1.13**	**1.48**	**2.15**	**2.58**	**2.97**	**2.96**	**3.06**	**3.10**	**2.68**	**3.31**	**3.54**	**2.66**
	Girls.	3.24	2.53	2.23	2.40	2.32	2.30	1.97	1.72	1.69	2.36	1.93	2.07
Sixteen to Seventeen	Boys.	**1.30**	**3.34**	**3.42**	**3.16**	**2.65**	**2.30**	**1.96**	**2.10**	**2.01**	**1.00**	**0.08**	**2.17**
	Girls.	1.37	1.56	1.66	1.63	1.37	1.50	1.56	1.19	1.37	1.94	1.26	1.54
Seventeen to Eighteen	Boys.	**5.23**	**4.19**	**3.62**	**3.96**	**3.39**	**3.15**	**3.08**	**2.39**	**1.84**	**1.78**	**1.29**	**3.13**
	Girls.	0.30	0.60	0.18	0.18	0.37	0.20		1.70				0.06

during the years 6 and 7 than at any other time, and in girls is nearly as great in these years as in the period of acceleration. The curve of girls' height sitting is very similar to that of girls' height standing. In both, the rate of growth is more uniform than in weight. Indeed, the period of acceleration in the last named dimension is greater than in any of the others. The relative annual increase of boys' height sitting seems almost atypical, by reason of its sharp ascent at ages 8 and 9 and its failure to sink after age 16. The latter feature is perhaps due to an error in the average value caused by the small number of observations at age 17. I am unable to explain the ascent at ages 9 and 10. The growth in span of arms is somewhat more rapid at ages 7 and 8 than during the prepubertal acceleration. The curve of girls' girth of chest differs from the usual type in its sudden rise at age 11, the increase at that year appearing slightly greater than at age 13. The boys' curve, on the contrary, agrees very well with the curves of weight, height, etc., except that the curve rises at age 18, where the number of observations, it may be repeated, is perhaps too small for very sure work. The quickness with which the strength of squeeze decreases after age 7 is certainly remarkable, as is the sharpness with which the prepubertal acceleration is shown.

Attention will be called in chapter IX, to the importance in children of the relation between height and weight, girth of chest and other physical dimensions. Unusual height, it will be pointed out, is commonly a disadvantage, because it entails an unusual loss of energy. If such individuals have a weight and girth of chest, etc., so much above the common as to compensate their excessive height, they are likely to be able to meet all demands on their strength. If they do not possess this compensatory development, they will probably be unable to meet any excessive demand. Thus the question of how far this compensation exists in any individual, or, more broadly stated, the question what weight, girth of chest, etc., should accompany any given height, becomes of the greatest interest. This interest, it should be remarked, is unusually great in the case of children, for children are taxed with the mechanical motion and other forms of dissipation of energy making up the ordinary output of life, and, in addition, with the extraordinary function of storing energy in the increase of tissue which constitutes growth.

In view of these facts, Plate XLV cannot fail to be instructive. It shows the ratio of span of arms, height sitting, chest-girth, weight, strength of squeeze with right hand, and five head and face measurements to height standing. Height standing is here expressed by an abscissa, and the percentage relation of weight and the other dimensions are displayed in curves. Of all these, span of arms most closely approximates the height, the difference being less than one per cent. of the latter from age 6 to 11 and scarcely more than 2 per cent. in subsequent ages. Span of arms in both sexes is therefore nearly the same as height standing throughout the period of observation, becoming very slightly greater than the height as growth progresses. The height sitting and the girth of chest run a parallel course and are, moreover, nearly equal, the girth of chest being about 2 per cent. less than the height sitting. They increase a little less rapidly than the height, showing a decline of about 4 per cent. in thirteen years. Height sitting and chest-girth are not far from half the height standing.

Far different is the development of weight and strength of squeeze. These increase much more rapidly than height, for at age 6 the height stands to weight in the ratio of 100 to 18 and to strength of squeeze as 100 to 6, while at age 16 these ratios are 100 to 34 and 100 to about 16, respectively. The parallelism in the development of weight and strength of squeeze is of much interest. The dimensions of head and face increase somewhat less rapidly than the height. The length of head, for example, falls from $\frac{1}{16}$th of the height, at age 6, to about $\frac{1}{11}$th at age 18.

CHAPTER VIII.

THE RELATION BETWEEN THE PHYSICAL DEVELOPMENT OF SCHOOL CHILDREN AND THEIR CAPACITY FOR MENTAL LABOR.

In Vol. VI, No. 7 of the Transactions of the Academy of Science of St. Louis, issued March 21, 1893, I demonstrated that children who possess more than the ordinary power of mental labor, as measured by their progress in their studies, are heavier, taller and larger in girth of chest and in width of head than their less gifted companions of the same age. A more extended statement of these observations was presented to the Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, July 15, 1893, and appears in Virchow's Zeitschrift für Ethnologie under the title Untersuchungen der Schulkinder in Bezug auf die physischen Grundlagen ihrer geistigen Entwickelung. In these papers, the material was the total number of observations irrespective of the social condition of parents. An example, selected from Tables Nos. 2 and 4, page 165 and 167, of The Physical Basis of Precocity and Dullness, will illustrate the result of the inquiry. Pupils aged 11 are found in Grades I, II, III, IV, V and VI of the St. Louis Public Schools, as the following table shows. The 59 boys of Grade I, the lowest grade, weigh less than the boys of Grade II, and these, again, are lighter than the boys in higher grades.

TABLE No. 35.

MEDIAN WEIGHT OF BOYS AGED 11 DISTRIBUTED BY SCHOOL GRADE.

Grades.	No. of Boys Weighed.	Median Weight.
I	59	28.83 Kg.
II	311	29.74 "
III	664	30.92 "
IV	546	31.43 "
V	123	32.41 "
VI	33	33.29 "

It is a well-known fact that children of the prosperous classes are better developed physically than the children of the poor. It has been suggested that the children of poor parents are not so successful in school work as the children of the rich, and that the poor children are compelled to leave school at an earlier age than the rich, and for these reasons are relatively less numerous than the rich in the higher grades. According to this idea, the better physical development of the children of the same age in the higher grades, as illustrated above in boys aged 11, is due to the preponderance in the higher grades of the well nourished children of the rich. This may be, and probably is, a factor in the phenomenon, but is surely only a partial influence.

For when children of the same age and as nearly as possible of the same social class are weighed and the weights distributed by school grade, it is found that they follow the law established for the whole material irrespective of social condition. A glance at Plate XLVI, derived from Table No. 36, will convince the reader of the truth of this statement.

TABLE No. 36.

MEDIAN WEIGHT OF THE DAUGHTERS OF MANUAL TRADESMEN DISTRIBUTED BY SCHOOL GRADE.

Age at Nearest Birthday.	Unit of Measurement and Number of Observations.	SCHOOL GRADES.							
		Kindergarten.	I.	II.	III.	IV.	V.	VI.	VII.
Seven	Kilogr. No. of Obs.	**19.73** 137	**21.14** 187						
Eight	Kilogr. No. of Obs.		**22.60** 287	**23.56** 136					
Nine	Kilogr. No. of Obs.		**24.00** 87	**25.33** 240	**25.79** 68				
Ten	Kilogr. No. of Obs.			**27.03** 152	**27.87** 170	**28.71** 33			
Eleven	Kilogr. No. of Obs.			**27.97** 49	**29.22** 135	**30.11** 116	**29.74** 27		
Twelve	Kilogr. No. of Obs.				**31.95** 65	**32.57** 140	**33.69** 76	**34.50** 32	
Thirteen	Kilogr. No. of Obs.				**34.16** 32	**36.32** 78	**36.66** 69	**39.16** 56	**40.18** 27
Fourteen	Kilogr. No. of Obs.					**38.59** 25	**41.31** 40	**40.68** 60	

Further evidence is afforded by Table No. 37, in which the daughters of professional men are divided into two equal groups, in the manner explained on page 177 of The Physical Basis of Precocity and Dullness, one group containing the fifty per cent who are found in the upper grades, the other the fifty per cent found in the lower grades. It should be remarked that this method of division diminishes the conspicuousness of the difference between lower and higher grades by not presenting the weights for outlying grades, but for a small number of observations it is much more reliable than the method of which Table No. 36 is an illustration.

TABLE No. 37.

MEDIAN WEIGHT OF THE DAUGHTERS OF PROFESSIONAL MEN DISTRIBUTED BY SCHOOL GRADE.

Age at Nearest Birthday.	Number of Observations.	School Grades.	Median Weight. (Kilogram's)	Median Weight. (Kilogram's)	School Grades.	Number of Observations.	Age at Nearest Birthday.
7	50	Kg., 10 I.	20.29	20.81	90 I, II.	50	7
8	52.5	Kg., 97 I.	22.13	23.75	3 I, II, III.	52.5	8
9	53.5	I, 69 II.	24.52	25.07	31 II, III, IV, V.	53.5	9
10	57.5	I, II, 48 III.	27.19	27.64	52 III, IV, V, VI.	57.5	10
11	58.0	I, II, III, 28 IV.	28.76	31.27	72 IV, V, VI, VII.	58.0	11
12	50	I, II, III, 81 IV.	33.65	34.05	19 IV, V, VI, VII.	50	12
13	55.5	II, III, IV, 78 V.	38.46	39.55	22 V, VI, VII, VIII.	55.5	13

The results of this study of the weights of girls from the same social class distributed by school grade confirm the conclusion reached in the publications cited above, namely that successful pupils are larger than the unsuccessful.

CHAPTER IX.

THE APPLICATION TO INDIVIDUAL SCHOOL CHILDREN OF THE MEAN VALUES DERIVED FROM ANTHROPOLOGICAL MEASUREMENTS BY THE GENERALIZING METHOD.

The data for the studies described in this work can be collected either by the "generalizing" or by the "individualizing" plan. In the former, a great number of measurements is made but once on individuals of different ages, and the measurements classified according to age. In the latter, the same individuals are measured yearly or oftener during their period of growth, and the measurements classified also by age. The generalizing method, the one pursued in the present investigation, is rapidly and easily carried out, whereas the individualizing method demands for its execution exceptional opportunities and exceptional patience, requiring not only that the measurements be made and the records kept through two decades, but that the number of children measured in the early years of this long period be very great, lest death and desertion so thin the ranks that those remaining to the end shall be too few to yield trustworthy conclusions. Both methods, when applied to the same material, give identical results with regard to means, including those of subdivisions as well as those of the whole number of observations. The individualizing method does more.

The importance of the individualizing method has been much emphasized, for the reason that it can give information without which the laws derived from means cannot, in the present state of knowledge, be applied to individuals. Before this application can be made, it is necessary to know the degree of probability that an individual, who at a given age stands at a certain deviation from the mean of any dimension will show the same deviation at other ages; for example, the degree of probability that a girl whose height at age 8 is 122.06 cm., and who therefore deviates 3.7 cm., or $+1d$ from the mean of her age (118.36 cm.), will deviate to the same degree ($+1d$) from the mean height throughout her growth. In that case, the law of growth for the type at a deviation of +1*d* from the mean is her law of growth. Otherwise, she is an exception and practical regulations deduced from the law for the type cannot be safely made binding on her. This knowledge, as has just been said, is furnished by the individualizing method, while the generalizing method is of no assistance in this matter.

The application to individuals of the law of growth of the mean is a subject of immediate practical interest. The connection between theory and practical affairs is here unusually short and clear. Were this application possible, the deviations of children from the laws of normal growth could be quickly recognized and largely overcome, the evil effect of over study could be watched and intelligently combated, and systems of education, no longer exacting of all that which should be exacted only from the mean, could be rationally adapted to the special needs of the exceptionally weak and the exceptionally strong.

These beneficent reforms, it is at present believed, must await the slow collection of data by the individualizing method. If it is indeed true that the laws of growth determined for the mean cannot be used for the individual until the individualizing method has established the probability of each individual deviation remaining constant throughout the period of growth, then a generation must elapse — so slow is the gathering of data by this method — before the necessary knowledge is in our hands. I hope to show that this long waiting is unnecessary, and that the data collected by the generalizing method may be used, in a way hitherto unrecognized, for the making of standards by which the deviation of an individual from the mean of his age may be seen to be normal or abnormal.

Let the problem be clearly understood. The question is: this boy or girl is above or below the mean height, or weight, etc., of his or her age. How shall it be known that this deviation is normal or abnormal? There has been hitherto
y reply to this question. A vague and partial
ble after two measurements separated by at
terval. If the deviation is the same, or very

nearly the same, at both measurements, the probability is that the child is growing normally. This probability is greater than the general probability that a normal deviation is more likely to occur than an abnormal one, but its numerical value is wholly unknown. If, on the other hand, the two deviations are unequal, the probability is that the greater of them is abnormal, but the numerical value is here also unknown. How definitely the individualizing method could answer this question is difficult of conjecture, in the present lack of data, but certainly no answer whatever could be expected except after two measurements separated by a year's interval, a year in which the unchecked cause of an abnormal deviation might inflict an irreparable damage on the organism. Such indefinite and fragmentary knowledge can never be the basis of a practical reform. Any solution of this problem which shall gain general acceptance must be easy to understand and easy to apply, and must give the probable degree of abnormality of any observed deviation. These conditions are, I believe, fulfilled by the following method.

According to the theory of probabilities, the heights of a thousand individuals of the same class will arrange themselves as follows: —

Between	$M+4d$	and	$M+nd$	3	individuals.
"	$M+3d$	"	$M+4d$	18	"
"	$M+2d$	"	$M+3d$	67	"
"	$M+d$	"	$M+2d$	162	"
"	M	"	$M+d$	250	"
"	M	"	$M-d$	250	"
"	$M-d$	"	$M-2d$	162	"
"	$M-2d$	"	$M-3d$	67	"
"	$M-3d$	"	$M-4d$	18	"
"	$M-4d$	"	$M-nd$	3	"

where M = the mean and d = the probable deviation.

Let these be divided into seven groups: —

I.	All	individuals	between	$M+nd$	and	$M+3d$	21
II.	"	"	"	$M+3d$	"	$M+2d$	67
III.	"	"	"	$M+2d$	"	$M+d$	162
IV.	"	"	"	M	"	$M\pm d$	500
V.	"	"	"	$M-d$	"	$M-2d$	162
IV.	"	"	"	$M-2d$	"	$M-3d$	67
VII.	"	"	"	$M-3d$	"	$M-nd$	21

The mean height, weight, girth of chest, etc., of each of these groups at any age will be the type of a certain degree of deviation from the mean of the age. That is to say, the weights, etc., of each group will be symmetrically distributed above and below the mean weight, etc., of the group in the manner already illustrated for the entire undivided number of observations, *i. e.*, the entire thousand. Each group, therefore, will be characterized by a physical development definitely determined by the means of height, weight and other physical dimensions. These means, taken together form the type or norm of the group. The individual deviations from this norm follow the theory of probability, and the degree of abnormality presented by any individual deviation can be expressed in the terms of this theory. An example will illustrate this. A boy X shows a deviation in height of $+1.5d$ from the mean height of his age. He falls therefore in Group III. The boys in this group possess a mean weight of M kilogrammes, with a probable deviation of $\pm d$; that is, boys between d and $2d$ taller than the norm of their age should weigh $M \pm d$ kilogrammes. In like manner, they should have a girth of chest of $M \pm d$ centimetres, and a span of arms of $M \pm d$ centimetres, and so on. If the weight, etc., of the boy X coincide with the means of his group (Group III) his physique is normal, the accuracy of this conclusion being proportionate to the number of different dimensions on which it is based. If the boy X deviate more than $\pm 1d$ from the mean in one or more dimensions, his development is abnormal, and the degree of abnormality is measured by the amount of his deviation.

The necessity of choosing some one dimension as the basis of such a system is self-evident. There are good reasons, partly theoretical and partly practical, why height rather than weight should be taken as a basis. Height is more stable, less liable to irrelevant fluctuations, than weight. An excess in weight can be reduced; a child whose weight is out of proportion to its height may be brought into proportion by suitable diet and exercise; but height, once attained, cannot be reduced, nor can the growth in height be easily influenced. Practically, therefore, the physical trainer must be content to bring the weight, girth of chest, strength of squeeze and other physical dimensions up to the mean development which corresponds to the height of the child. Experience has abundantly shown that the relation of weight to height is of great importance to health, life insurance companies declining to receive applicants whose weight falls much below the standard weight of their height. For these reasons, height should be preferred as the basis of the system.

The question whether any given deviation is normal or abnormal is answered by this system in two ways: in respect of height, by the degree of deviation from the mean or norm of the whole number of observations; in respect of other dimensions, by the degree of deviation of the weight, girth of chest, etc., from the mean weight or girth of chest corresponding to the height of the individual under examination, this normal weight, etc., being determined with sufficient exactness by taking the means and probable deviations of the group in which the height falls. It is evident that all cases included within $M \pm d$ must be termed normal, for the chances are even that any individual measurement in a series will fall within $M \pm d$ and are against its exceeding these limits, being 4.64 against 1 that it will fall at $M \pm 2d$.

Strictly speaking, all abnormal deviations in any dimension are probably unhealthful, yet an important difference exists in this respect between abnormal deviations in height and abnormal deviations in weight, girth of chest, etc., as related to height. It cannot be doubted that abnormal height is probably (using the word in its technical sense) a disadvantage. The potential energy of the body is converted into mechanical labor and heat, by far the greater expenditure taking the latter form. In the adult, the total expenditure in the form of heat is about 2,700 calories in 24 hours (Helmholtz), of which 80.1 per cent escape in radiation, conduction and evaporation from the skin. Thus the superficies of the body plays a great part in the dissipation of energy. The superficies is greater, usually, in tall children than in short, a difference of special importance in the young, in whom metabolism is much more active than in the adult. More heat is therefore lost by the abnormally tall than by those of normal height. There is a disadvantage also in the loss by mechanical labor. Greater height entails increased work on the heart and on the skeletal muscles. In short, increased loss of energy goes hand in hand with increase in height. Hence in the tall the necessity for a physical development which shall be so much above the mean as to compensate their greater loss of energy. In growing children not only must there be compensation for the expenditure of energy, but there must be also energy stored in the increase of tissue which constitutes growth.

If the greater demands of tall children are balanced by a correspondingly greater income of energy, a normal equilibrium or "health" is preserved. It should be clearly recognized that this equilibrium is unaffected by the absolute height and is dependent only on the relation between height and the other physical dimensions. Consequently health is as possible in tall children as in those of normal height, although less probable, for the chances against a compensatory development of weight and other dimensions increase very rapidly with the deviation of the height from the norm. The absolute height of an individual is of very secondary interest from a practical point of view, because it is not necessarily a state of ill health, whereas the development of weight, girth of chest, etc., in proportion to height is of supreme interest. A lack of proportion between height and other physical dimensions is itself ill health. The tendency of organisms to adopt ends to means is strong, and an imperfect compensation may suffice for most demands. A heart in which an hypertrophy of the left ventricle has partially compensated an insufficiency of the mitral valve may beat regularly enough for ordinary exertions, and yet fail utterly when its possessor is forced suddenly to ascend a height or to make any other unusual exertion. So a tall child may have a sufficient income of energy to meet the demands of a wisely regulated life, and sink under the burden of unusual tasks.

It has been shown in the foregoing pages that the means derived from anthropometrical metrical measurements by the generalizing method can be used to determine whether the weight and other physical dimensions of an individual are normal in relation to height, and it has been pointed out that this normal relation constitutes health. It follows that the normal amount of labor cannot be exacted without injury from those in whom this equilibrium is wanting. These facts must therefore be taken into account in a rational school system, and it should now be made plain how this is to be done.

All systems of education have for their object the largest possible development of individual minds. In large schools the tasks by which this development is promoted are those which secure from the child of mean ability its maximum mental output. In practice they are determined by examinations. Hence the existence in every educational institution of classes based on the mental output of the mean pupil, and related to age only in that the output fixed as the standard of any class is necessarily found more often at a certain age than at other ages. Thus there exists a mean age for each class; the greater number of pupils at any age is found in the same class, while some have advanced beyond, and others, equally old, have not yet come so far as this class. On an average, those who have advanced beyond the greater number of their age are precocious, that is, possess more than the mean capacity for mental labor, while those who are less advanced are dull, possessing less than the mean capacity. It has been demonstrated that there is a physical basis for precocity and dullness:[1] when numbers sufficiently large for statistical purposes are employed, it is seen that precocious pupils are of greater mean weight, height, etc., than the mean pupils and that the latter are heavier and taller that the dull. The mental output is therefore directly related to the physical condition of the pupils. The mean height, weight, girth of chest, etc., in any grade is the mean physical development corresponding to the mental output of the grade. It follows that those who do not possess this development cannot without abnormal strain do the work exacted in this grade. On the other hand, pupils who possess more than the mean physical development of their age should be capable of more than the mean labor. Yet the management of this latter class presents but few difficulties, whereas the former class cannot be too carefully protected.

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[1] See Chapter VIII, page 335 *et seq.*

The consequences of continued overstrain in a growing boy or girl are most unhappy. The curves of growth in height and weight of the mean child are characteristic. The quick rise to age 7 or 8, the slower ascent to age 11 in girls and 13 in boys, the remarkable three years of accelerated development preceding puberty, and, finally, the rapid decrease in the rate of growth as full development approaches express the normal development of the type and, presumably, the normal development of the individual. Overwork may cause a temporary or a permanent deviation in these curves. It is probable, though not certain, that a temporary loss consequent on a slight overstrain may not lower the final outcome of the development, but there can be no doubt as to the result of a prolonged strain. In such a case, the probability is strong that the whole subsequent curve will be turned out of its course. A prolonged strain in a growing child harms for life and leaves a mark which can never be effaced. The danger is greatest in the periods of quickest development, particularly great in the prepubertal period. It is a sufficient commentary on the evils of the present educational methods that during these very years the undiscriminating routine of a system devised for the average pupil is most inflexibly applied to weak and strong alike.

Overstrain can often be recognized both by subjective and objective symptoms. Subjective symptoms, however, are frequently obtained with difficulty, especially in pupils who are unusually ambitious and who overstudy from choice. An objective symptom must therefore be found — a symptom easily demonstrated and almost never wanting. Such a symptom is the failure to gain weight at the normal rate. A persistent loss of weight in an adult is regarded as a matter of grave concern: the persistent failure of a child to make the normal gain in weight is no less grave. It is not pretended that the failure to gain weight always accompanies overstrain, but it is claimed that the number of exceptions is small and that frequent weighing is the most practical and on the whole the most certain method of detecting the presence of influences that are working injury to the development of the child. The skillful breeder of cattle depends on systematic weighing to inform him if his efforts are meeting with success, but children are left to grow at haphazard.

It is not enough that overstrain should be recognized by the harm it has done. The child should be guarded against the possibility of harm. The anthropometrical system proposed offers a means of doing this. It infallibly discovers the children whose physical development is below the standard of their age. It no less certainly indicates the physical development which most often accompanies the power to do the mental work of any grade. It therefore divides the pupils into two bodies; those physically competent and those physically incompetent for a clearly defined degree of mental exertion. When working with great numbers, the infallibility of this system is practically absolute and theoretically almost absolute. When applied to individuals, errors will certainly occur, but the number of errors will according to the laws of probability be less than the number of correct conclusions, and these errors cannot influence the great fact that such a system is competent to call attention to the children who will probably be unable to do the normal work of their age without injury. Each individual case must then be treated on its own merits.

The proposed system of physical examination requires: —

I. The collection of sufficiently extensive data by the generalizing method.

II. The determination of the means and the probable deviations of height, weight, girth of chest, strength of squeeze, etc., for each age.

III. The division of the individuals at each age into groups in terms of the probable deviation from the mean height, as illustrated above, and the calculation of the mean and probable deviation of the weight, girth of chest, etc., of each group.

IV. The determination of the mean physical development of the pupils in each class or grade of the school system.

V. The physical examination of each applicant for entrance to any grade.

These data permit the enforcement of the following regulation: That no pupil whose physical development varies more than ±*d* from the weight, etc., of the mean pupil of his height in a class which his mental output would otherwise entitle him to enter, shall be admitted to that class, unless with the approval of a medical expert, if possible a regularly appointed school physician, who shall testify that the pupil's strength will be equal to the strain.

TABLES NO. 38 TO 51.

The tables which follow this page repeat some of the more commonly used statistical values in a form which admits of ready reference and comparison. Such are the average, probable error of the average, probable deviation, median or 50 percentile grade and median minus average values. Yet these tables are by no means summaries of the statistical calculations of the investigation, since they omit much that is given in the foregoing pages. They contain, moreover, not a little new matter. The relation of probable deviation to average, relation of average to height standing, relative annual increase of average, the 25 percentile grade, the 75 percentile grade, the cranial indices and the absolute annual increase of average of strength of squeeze and of measurements of the head and face are here presented for the first time.

Some of this material has been already discussed in this paper. Some is reserved for future discussion. One series, the relation of probable deviation to average, was treated at some length in my paper on "The relation between the growth of children and their deviation from the physical type of their sex and age," *Transactions of the Academy of Science of St. Louis*, Vol. VI, No. 10, pp. 233–250, November 14, 1893, to which the reader is referred.

Five dynamometers were used in testing the strength of squeeze; they were distinguished by the first five letters of the alphabet; A and D were graduated alike; C and E were also alike but differed from A and D, and B differed from all the others. The original values obtained with these various instruments are set down in Tables No. 45 and 46; from them were made Tables No. 43 and 44, by reducing the arbitrary graduation of all dynamometers to a uniform scale in kilogrammes.

TABLE No. 38.

THE HEIGHT STANDING.

AGE AT NEAREST BIRTHDAY.	SEX.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%		%				
Six	**Boys.**	**709**	Centimetr's	**108.94**	**0.128**	**3.40**	**3.1**			**105.99**	**109.23**	**112.69**	**+0.29**
	Girls.	780		107.67	0.123	3.42	3.2			104.74	108 10	111.30	+0.43
Seven	**Boys.**	**1850**	"	**114.03**	**0.084**	**3.61**	**3.2**	**5.08**	**4.7**	**111.02**	**114.48**	**118.02**	**+0.45**
	Girls.	1791		112.95	0.089	3.75	3.3	5.28	4.9	109.72	113.44	117.07	+0.49
Eight	**Boys.**	**2223**	"	**119.13**	**0.082**	**3.89**	**3.3**	**5.10**	**4.7**	**116.08**	**119.77**	**123.58**	**+0.64**
	Girls.	2193		118.36	0.079	3.70	3.1	5.41	4.8	115.07	118.74	122.35	+0.38
Nine	**Boys.**	**2205**	"	**124.35**	**0.080**	**3.75**	**3.0**	**5.22**	**4.4**	**121.09**	**124.87**	**128.76**	**+0.52**
	Girls.	2122		123.67	0.83	3.83	3.1	5.31	4.5	120.90	124.11	127.58	+0.44
Ten	**Boys.**	**2087**	"	**128.87**	**0.087**	**3.98**	**3.1**	**4.52**	**3.6**	**125.49**	**129.45**	**133.54**	**+0.68**
	Girls.	2053		128.43	0.089	4.06	3.1	4.76	3.9	124.96	128.85	132.58	+0.42
Eleven	**Boys.**	**1819**	"	**133.84**	**0.099**	**4.23**	**3.2**	**4.97**	**3.9**	**130.08**	**134.44**	**138.29**	**+0.60**
	Girls.	1772		133.19	0.106	4.48	3.2	4.76	3.7	129.23	133.60	137.97	+0.41
Twelve	**Boys.**	**1653**	"	**138.21**	**0.116**	**4.47**	**3.2**	**4.37**	**3.3**	**134.25**	**138.57**	**142.99**	**+0.36**
	Girls.	1732		139.11	0.098	5.23	3.4	5.92	4.4	134.61	139.54	144.44	+0.43
Thirteen	**Boys.**	**1268**	"	**142.91**	**0.140**	**4.98**	**3.5**	**4.70**	**3.4**	**138.45**	**143.29**	**148.28**	**+0.38**
	Girls.	1322		146.53	0.150	5.46	3.8	7.42	5.3	140.98	146.19	151.79	—0.34
Fourteen	**Boys.**	**925**	"	**148.58**	**0.183**	**5.58**	**3.8**	**5.67**	**4.0**	**143.43**	**148.86**	**154.52**	**+0.28**
	Girls.	1085		150.84	0.156	5.15	3.7	4.31	2.9	146.85	151.94	156.32	+1.10
Fifteen	**Boys.**	**490**	"	**154.90**	**0.286**	**6.33**	**4.1**	**6.32**	**4.3**	**148.88**	**155.25**	**161.86**	**+0.35**
	Girls.	680		155.04	0.154	4.01	3.4	4.20	2.8	151.75	155.82	159.58	+0.78
Sixteen	**Boys.**	**189**	"	**160.27**	**0.427**	**5.87**	**3.7**	**5.37**	**3.5**	**155.28**	**161.27**	**167.04**	**+1.00**
	Girls.	420		157.52	0.197	4.05	2.6	2.48	1.6	153.94	158.03	161.81	+0.51
Seventeen	**Boys.**	**78**	"	**165.13**	**0.592**	**5.15**	**3.1**	**4.86**	**3.0**	**160.79**	**166.00**	**171.34**	**+0.87**
	Girls.	206		159.33	0.241	3.45	2.2	1.81	1.1	155.65	159.40	162.93	+0.07
Eighteen	**Boys.**	**29**	"	**170.41**	**0.924**	**4.98**	**2.8**	**5.28**	**3.2**		**170.50**		**+0.09**
	Girls.	164		159.42	0.265	3.39	2.1	0.09	0.06	156.40	159.50	163.29	+0.08
Nineteen	Girls.	85	"	158.46	0.438	4.04	2.6			154.32	159.56	163.27	+1.10
Twenty	Girls.	79	"	159.41	0.358	3.08	2.0				159.83		+0.42
Twenty-one	Girls.	43	"	159.98	0.651	4.27	2.7				160.50		+0.52

TABLE No. 39.

The Weight.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E	Probable Deviation d	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	**Boys.**	**707**	Kilogram.	**19.75**	**0.054**	**1.43**	**7.2**	**18.1**			**18.57**	**19.85**	**21.27**	**+0.10**
	Girls.	798		18.93	0.051	1.44	7.6	17.6			17.70	18.99	20.44	+0.06
Seven	**Boys.**	**1814**	"	**21.67**	**0.039**	**1.68**	**7.8**	**19.0**	**1.92**	**9.7**	**20.14**	**21.66**	**23.36**	**—0.01**
	Girls.	1714		20.82	0.045	1.88	9.0	18.4	1.89	10.0	19.25	20.81	22.55	—0.01
Eight	**Boys.**	**2188**	"	**23.78**	**0.042**	**1.96**	**8.2**	**20.0**	**2.11**	**9.7**	**22.00**	**23.87**	**25.85**	**+0.09**
	Girls.	2147		22.88	0.042	1.95	8.5	19.3	2.06	9.9	21.02	22.85	24.75	—0.03
Nine	**Boys.**	**2188**	"	**26.06**	**0.045**	**2.09**	**8.0**	**21.0**	**2.28**	**9.6**	**24.17**	**26.22**	**28.28**	**+0.16**
	Girls.	2055		25.08	0.049	2.23	8.9	20.3	2.20	9.6	23.07	25.04	27.31	—0.04
Ten	**Boys.**	**2064**	"	**28.32**	**0.049**	**2.23**	**7.9**	**22.0**	**2.26**	**8.7**	**26.07**	**28.36**	**30.81**	**+0.04**
	Girls.	1947		27.49	0.052	2.31	8.4	21.4	2.41	9.6	25.08	27.45	29.96	—0.04
Eleven	**Boys.**	**1743**	"	**31.00**	**0.062**	**2.60**	**8.4**	**23.2**	**2.68**	**9.5**	**28.50**	**31.08**	**33.66**	**+0.08**
	Girls.	1708		30.15	0.070	2.91	9.6	22.6	2.66	9.7	27.28	29.80	32.84	—0.35
Twelve.......	**Boys.**	**1644**	"	**33.51**	**0.061**	**2.46**	**7.3**	**24.2**	**2.51**	**8.1**	**30.65**	**33.41**	**36.26**	**—0.10**
	Girls.	1676		33.66	0.081	3.31	9.8	24.2	3.51	11.6	30.05	33.25	36.83	—0.41
Thirteen	**Boys.**	**1242**	"	**36.61**	**0.110**	**3.88**	**10.6**	**25.6**	**3.10**	**9.3**	**32.88**	**36.25**	**39.86**	**—0.36**
	Girls.	1343		38.49	0.115	4.22	11.0	26.3	4.83	14.3	33.86	38.00	42.79	—0.49
Fourteen	**Boys.**	**946**	"	**40.44**	**0.148**	**4.56**	**11.3**	**27.2**	**3.83**	**10.5**	**36.41**	**39.98**	**45.38**	**—0.46**
	Girls.	1082		42.29	0.142	4.67	11.0	28.0	3.80	9.9	37.87	42.65	47.55	+0.36
Fifteen	**Boys.**	**498**	"	**46.22**	**0.227**	**5.06**	**11.0**	**29.8**	**5.78**	**14.3**	**40.04**	**45.49**	**51.75**	**—0.73**
	Girls.	690		46.69	0.154	4.05	8.7	30.1	4.40	10.4	42.59	46.85	50.66	+0.16
Sixteen	**Boys.**	**203**	"	**51.60**	**0.431**	**6.16**	**12.0**	**32.0**	**5.38**	**11.6**	**45.66**	**51.83**	**57.99**	**+0.23**
	Girls.	420		50.25	0.207	4.24	8.4	31.9	3.56	7.6	46.56	49.96	54.96	—0.29
Seventeen	**Boys.**	**71**	"	**55.67**	**0.521**	**4.38**	**7.9**	**33.7**	**4.07**	**7.9**	**51.94**	**55.31**	**61.21**	**—0.36**
	Girls.	230		52.61	0.244	3.70	7.0	33.0	2.36	4.7	48.67	52.52	56.47	—0.09
Eighteen	Girls.	155	"	52.36	0.289	3.60	6.9	33.0			49.27	53.10	56.83	+0.74
Nineteen	Girls.	81	"	52.19	0.332	3.76	7.2	32.8			48.93	52.47	55.74	+0.28
Twenty	Girls.	66	"	53.91	0.565	3.76	7.0	33.7			50.01	53.57	57.33	—0.34

TABLE No. 40.

The Height Sitting.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	Boys.	714	Centimetr's	61.31	0.105	2.82	4.6	56.3			59.11	60.77	63.02	−0.54
	Girls.	751		59.45	0.132	2.03	3.4	55.2			58.23	60.11	62.05	+0.66
Seven	Boys.	1853	"	63.32	0.061	2.64	4.2	55.5	2.01	3.3	61.16	63.22	65.22	−0.10
	Girls.	1727		61.80	0.053	2.19	3.5	54.7	2.45	4.1	60.58	62.44	64.56	+0.64
Eight..........	Boys.	2239	"	64.74	0.048	2.26	3.5	54.4	1.42	2.2	63.22	65.21	67.17	+0.47
	Girls.	2120		63.97	0.044	2.04	3.2	54.0	2.17	3.5	62.71	64.96	66.37	+0.99
Nine	Boys.	2258	"	66.73	0.049	2.34	3.5	53.7	1.99	3.1	65.05	67.08	69.32	+0.35
	Girls.	2071		66.16	0.046	2.11	3.2	53.5	2.19	3.4	64.78	66.19	68.82	+0.03
Ten	Boys.	2118	"	69.25	0.040	2.42	3.5	53.7	2.52	3.8	66.90	69.18	71.35	−0.07
	Girls.	2037		68.19	0.049	2.19	3.2	53.1	2.03	3.1	66.72	68.88	70.99	+0.69
Eleven	Boys.	1828	"	70.67	0.060	2.56	3.6	52.8	1.42	2.1	68.78	71.09	73.23	+0.42
	Girls.	1748		70.03	0.057	2.37	3.4	52.6	1.84	2.7	67.96	70.62	72.94	+0.59
Twelve.......	Boys.	1656	"	72.55	0.067	2.72	3.8	52.5	1.88	2.7	70.49	72.68	75.03	+0.13
	Girls.	1707		72.67	0.063	2.61	3.6	52.2	2.64	3.8	70.69	73.22	75.78	+0.55
Thirteen	Boys.	1285	"	74.20	0.076	2.74	3.7	51.9	1.65	2.3	72.03	74.49	76.88	+0.29
	Girls.	1354		76.03	0.078	2.87	3.8	51.9	3.36	4.6	73.78	76.52	79.44	+0.49
Fourteen	Boys.	936	"	76.84	0.103	3.15	4.1	51.7	2.64	3.6	74.37	76.71	79.87	−0.13
	Girls.	1065		78.68	0.095	3.11	4.0	52.2	2.65	3.5	76.50	79.61	82.23	+0.93
Fifteen.......	Boys.	498	"	79.74	0.161	3.59	4.5	51.5	2.90	3.8	76.51	79.67	83.73	−0.07
	Girls.	674		81.42	0.098	2.54	3.1	52.5	2.74	3.5	79.76	82.20	84.58	+0.78
Sixteen.......	Boys.	193	"	82.28	0.250	3.48	4.2	51.3	2.54	3.2	79.37	83.22	86.32	+0.94
	Girls.	411		83.76	0.116	2.36	2.8	53.2	2.34	2.9	82.16	84.50	86.52	+0.74
Seventeen	Boys.	77	"	85.68	0.427	3.77	4.4	51.9	3.40	4.1	83.35	86.62	89.55	+0.94
	Girls.	202		84.66	0.153	2.17	2.6	53.2	0.90	1.1	83.00	85.41	87.30	+0.75
Eighteen......	Boys.	31	"	88.23	0.536	2.89	3.3	51.7	2.55	3.1	85.86	87.70	92.39	−0.53
	Girls.	167		85.20	0.133	1.72	2.0	53.7	0.54	0.6	84.26	85.89	87.56	+0.69
Nineteen	Girls.	85		84.86	0.198	1.82	2.1	53.3			83.96	85.68	87.27	+0.82
Twenty.......	Girls.	78		85.31	0.230	2.03	2.4	53.3			84.15	86.00	88.08	+0.69
Twenty-one ..	Girls.	41		85.05	0.290	1.86	2.2					85.79		+0.74

TABLE No. 41.

THE SPAN OF ARMS.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	**Boys.**	**708**	Centimetre.	**108.95**	**1.044**	**3.85**	**3.5**	**100.0**			**105.66**	**109.57**	**113.60**	**+0.62**
	Girls.	769		106.96	0.140	3.87	3.6	99.4			104.18	107.29	111.41	+0.33
Seven	**Boys.**	**1862**	"	**114.42**	**0.096**	**4.16**	**3.6**	**100.3**	**5.47**	**5.0**	**111.09**	**115.08**	**118.87**	**+0.66**
	Girls.	1724		112.36	0.107	4.18	3.7	99.5	5.40	5.0	108.76	113.11	117.27	+0.75
Eight	**Boys.**	**2234**	"	**120.07**	**0.088**	**4.18**	**3.5**	**100.8**	**5.65**	**4.9**	**116.52**	**120.73**	**124.71**	**+0.66**
	Girls.	2152		118.33	0.092	4.28	3.6	100.0	5.97	5.3	114.70	118.13	122.53	—0.20
Nine	**Boys.**	**2272**	"	**125.18**	**0.089**	**4.25**	**3.4**	**100.7**	**5.11**	**4.3**	**121.55**	**125.67**	**129.93**	**+0.49**
	Girls.	2065		123.63	0.092	4.18	3.4	100.0	5.30	4.5	120.15	124.28	128.42	+0.65
Ten	**Boys.**	**2076**	"	**130.22**	**0.103**	**4.70**	**3.6**	**101.0**	**5.04**	**4.0**	**126.19**	**130.61**	**135.49**	**+0.39**
	Girls.	2045		128.75	0.104	4.69	3.6	100.2	5.12	4.1	124.63	129.18	133.74	+0.43
Eleven	**Boys.**	**1810**	"	**135.13**	**0.113**	**4.84**	**3.6**	**100.9**	**4.91**	**3.8**	**130.89**	**135.59**	**140.57**	**+0.46**
	Girls.	1757		134.24	0.116	4.87	3.6	100.8	5.49	4.3	129.42	134.56	139.48	+0.22
Twelve.......	**Boys.**	**1664**	"	**140.60**	**0.112**	**4.57**	**3.2**	**101.7**	**5.47**	**4.1**	**135.55**	**140.48**	**145.43**	**—0.12**
	Girls.	1718		140.07	0.109	4.51	3.2	100.7	5.83	4.3	135.12	140.60	146.05	+0.53
Thirteen	**Boys.**	**1281**	"	**145.09**	**0.159**	**5.71**	**3.9**	**101.5**	**4.49**	**3.2**	**140.08**	**145.33**	**151.37**	**+0.24**
	Girls.	1368		147.19	0.150	5.55	3.8	100.5	7.12	5.1	142.10	147.83	153.39	+0.64
Fourteen	**Boys.**	**934**	"	**151.28**	**0.197**	**6.03**	**4.0**	**101.8**	**6.19**	**4.3**	**146.00**	**151.62**	**157.36**	**+0.34**
	Girls.	1088		152.58	0.160	5.29	3.5	101.2	5.39	3.7	148.30	153.56	158.54	+0.98
Fifteen.......	**Boys.**	**495**	"	**158.43**	**0.321**	**7.15**	**4.5**	**102.3**	**7.15**	**4.7**	**151.81**	**158.79**	**166.04**	**+0.36**
	Girls.	677		156.38	0.176	4.58	2.9	100.9	3.80	2.5	152.62	156.21	161.41	—0.17
Sixteen	**Boys.**	**189**	"	**163.96**	**0.574**	**7.89**	**4.8**	**102.3**	**5.53**	**3.5**	**158.04**	**165.31**	**171.49**	**+1.35**
	Girls.	413		158.51	0.217	4.41	2.8	100.7	2.13	1.4	155.39	159.31	163.26	+0.80
Seventeen	**Boys.**	**75**	"	**168.56**	**0.581**	**5.03**	**3.0**	**102.1**	**4.60**	**2.8**	**164.77**	**169.58**	**175.38**	**+1.02**
	Girls.	202		159.01	0.285	4.05	2.5	102.1	0.50	3.2	155.36	159.62	163.45	+0.61
Eighteen	**Boys.**	**32**	"	**175.31**	**0.761**	**4.31**	**2.5**	**102.9**	**6.75**	**4.0**	**171.14**	**175.50**	**179.94**	**+0.19**
	Girls.	164		160.47	0.334	4.28	2.7	101.3	1.46	0.9	156.65	161.38	165.41	+0.91
Nineteen	Girls.	83	"	158.45	0.517	4.71	2.9	101.8			155.17	158.90	163.09	+0.45
Twenty	Girls.	76	"	160.17	0.474	4.13	2.6	100.1			156.45	161.50	164.98	+1.33
Twenty-one ..	Girls.	37	"	161.27	0.712	4.33	2.7	100.1			157.40	160.88	166.68	—0.39

TABLE No. 42.

THE GIRTH OF CHEST MIDWAY BETWEEN INSPIRATION AND EXPIRATION.*

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	**Boys.**	**677**	Centimetre.	**59.05**	**0.083**	**2.22**	**3.8**	**54.2**			**57.45**	**59.32**	**61.42**	**+0.27**
	Girls.	741		58.34	0.091	2.48	4.3	54.2			56.81	58.87	60.98	+0.53
Seven	**Boys.**	**1708**	"	**60.62**	**0.057**	**2.38**	**3.9**	**53.1**	**1.57**	**2.7**	**58.79**	**60.89**	**63.25**	**+0.63**
	Girls.	1631		59.47	0.062	2.47	4.2	52.7	1.13	1 9	57.65	59.87	62.31	+0.40
Eight	**Boys.**	**2095**	"	**62.18**	**0.052**	**2.35**	**3.8**	**52.2**	**1.56**	**2.6**	**60.49**	**62.55**	**65.13**	**+0.37**
	Girls.	2040		60.81	0.053	2.40	3.9	51.3	1.34	2.3	58.94	61.34	63.80	+0.53
Nine	**Boys.**	**2120**	"	**63.90**	**0.055**	**2.51**	**3.9**	**51.4**	**1.72**	**2.8**	**61.97**	**64.33**	**66.91**	**+0.43**
	Girls.	1966		62.51	0.057	2.53	4.0	50.6	1.70	2.8	60.65	63.03	65.60	+0.52
Ten	**Boys.**	**1997**	"	**65.59**	**0.061**	**2.72**	**4.1**	**50.9**	**1.69**	**2.6**	**63.49**	**65.92**	**68.64**	**+0.33**
	Girls.	1893		63.02	0.061	2.67	4.2	49.1	0.51	0.8	61.18	64.46	67.16	+0.45
Eleven	**Boys.**	**1732**	"	**67.24**	**0.063**	**2.61**	**3.9**	**50.2**	**1.65**	**2.5**	**65.29**	**67.68**	**70.32**	**+0.44**
	Girls.	1654		65.85	0.075	3.04	4.6	49.4	2.83	4.5	63.38	66.36	69.12	+0.52
Twelve..... .	**Boys.**	**1565**	"	**68.76**	**0.074**	**2.94**	**4.3**	**49.8**	**1.52**	**2.3**	**66.53**	**69.17**	**72.06**	**+0.41**
	Girls.	1624		68.34	0.081	3.24	4.7	49.1	2.49	3.8	65.67	68.49	72.04	+0.16
Thirteen	**Boys.**	**1228**	"	**70.61**	**0.089**	**3.11**	**4.4**	**49.4**	**1.85**	**2.7**	**68.09**	**71.01**	**74.18**	**+0.40**
	Girls.	1313		71.29	0.098	3.54	5.0	48.6	2.95	4.3	68.32	71.64	75.13	+0.35
Fourteen	**Boys.**	**925**	"	**73.27**	**0.118**	**3.58**	**4.9**	**49.3**	**2.66**	**3.8**	**70.24**	**73.38**	**77.27**	**+0.11**
	Girls.	1020		74.13	0.114	3.65	4.9	49.5	2.84	4.0	71.03	74.59	78.29	+0.46
Fifteen.......	**Boys.**	**498**	"	**76.56**	**0.169**	**3.77**	**4.9**	**49.4**	**3.29**	**4.5**	**73.25**	**76.94**	**80.82**	**+0.38**
	Girls.	659		76.78	0.143	3.70	4.7	50.1	2.65	3.6	73.67	76.92	81.15	+0.15
Sixteen	**Boys.**	**205**	"	**79.22**	**0.293**	**4.19**	**5.3**	**49.4**	**2.66**	**3.5**	**75.61**	**79.90**	**83.71**	**+0.68**
	Girls.	397		78.85	0.164	3.27	4.1	50.5	2.07	2.7	75.98	79.22	82.85	+0.37
Seventeen	**Boys.**	**80**	"	**81.39**	**0.353**	**3.15**	**3.9**	**49.3**	**2.17**	**2.7**	**78.90**	**82.20**	**85.77**	**+0.81**
	Girls.	206		80.39	0.233	3.34	4.2	50.8	1.54	2.0	77.53	80.72	84.13	+0.34
Eighteen	**Boys.**	**31**	"	**84.52**	**0.528**	**2.94**	**3.5**	**49.6**	**3.13**	**3.8**	**82.69**	**85.35**	**88.38**	**+0.83**
	Girls.	162		80.45	0.254	3.23	4.0	49.7	0.06	0.1	77.68	80.92	84.90	+0.47
Nineteen	Girls.	82	"	79.10	0.380	3.43	4.3	50.3			76.61	79.81	82.84	+0.71
Twenty......	Girls.	66	"	80.54	0.339	2.76	3.4				78.20	81.04	83.99	+0.61
Twenty-one ..	Girls.	32	"	81.51	0.521	2.82	3.5				78.63	81.49	84.99	−0.03

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* Obtained by adding the Girth of Chest at full Inspiration to the Girth of Chest at full Expiration and dividing by 2.

TABLE No. 43.

THE STRENGTH OF SQUEEZE, RIGHT HAND.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	Median or 50 Percentile Grade.	Median Minus Average.
					±	±	%	%		%		
Six	Boys.	626	Kilogram.	6.09	0.056	1.41	23.2	5.6			6.30	+0.21
	Girls.	687		5.14	0.053	1.39	27.0	4.8			5.93	+0.79
Seven	Boys.	1551	"	7.69	0.039	1.52	19.8	6.7	1.60	26.2	7.67	—0.02
	Girls.	1493		6.53	0.043	1.67	25.6	5.8	1.39	27.0	6.56	+0.03
Eight	Boys.	1880	"	9.38	0.045	1.95	20.8	7.9	1.69	22.0	9.59	+0.21
	Girls.	1873		8.11	0.043	1.87	23.1	6.9	1.58	24.2	8.24	+0.13
Nine	Boys.	2002	"	11.35	0.055	2.45	21.6	9.1	1.97	21.0	10.65	—0.70
	Girls.	1829		9.23	0.049	2.11	22.9	7.5	1.12	13.8	9.14	—0.09
Ten	Boys.	1878	"	12.83	0.061	2.66	20.7	10.0	1.48	13.0	12.72	—0.11
	Girls.	1801		10.42	0.053	2.27	21.9	8.1	1.19	12.9	10.36	—0.06
Eleven	Boys.	1644	"	14.37	0 068	2.74	19.1	10.7	1.54	12.0	14.29	—0.08
	Girls.	1613		11.80	0.060	2.42	20.5	8.9	1.36	13.1	12.07	+0.27
Twelve	Boys.	1506	"	16.70	0.082	3.17	18.8	12.1	2.33	16.2	16.56	—0.14
	Girls.	1553		13.46	0.072	2.83	21.0	9.7	1.66	14.1	13.39	—0.07
Thirteen	Boys.	1152	"	19.08	0.126	4.27	22.4	13.3	2.38	14.2	18.99	—0.09
	Girls.	1256		16.13	0.093	3.31	20.5	11.0	2.67	19.8	15.51	—0.62
Fourteen	Boys.	848	"	22.32	0.143	4.15	18.6	15.0	3.24	17.0	21.82	—0.50
	Girls.	950		18.02	0.133	4.11	22.8	12.0	1.89	11.7	17.78	—0.24
Fifteen	Boys.	447	"	26.69	0.244	5.10	19.1	17.2	4.37	19.6	26.17	—0.52
	Girls.	617		20.01	0.147	3.65	18.2	12.9	1.99	11.0	20.32	+0.31
Sixteen	Boys.	163	"	31.04	0.414	5.29	17.0	19.4	4.35	16.3	29.90	—1.14
	Girls.	356		21.78	0.200	3.77	17.3	13.8	1.77	8.8	21.60	—0.18
Seventeen	Boys.	21	"		0.458						30.70	
	Girls.	112		21.88				13.7	0.10	4.6	22.25	+0.37
Eighteen	Girls.	75	"	24.13				15.2	2.25	10.0	24.88	+0.75
ineteen	Girls.	53	"	21.82				13.7			22.25	+0.43
y	Girls.	61	"	22.92				14.3			22.81	—0.11
y-one	Girls.	38	"								24.00	

TABLE No. 44.

The Strength of Squeeze, Left Hand.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	Median or 50 Percentile Grade.	Median Minus Average.
					±	±	%	%		%		
Six	**Boys.**	**629**	Kilogram.	**5.59**	**0.057**	**1.43**	**25.6**	**5.1**			**6.12**	**+0.53**
	Girls.	686		4.77	0.056	1.47	30.8	4.4			5.46	+0.69
Seven	**Boys.**	**1550**	"	**7.15**	**0.044**	**1.72**	**24.1**	**6.3**	**1.56**	**27.9**	**7.11**	**—0.04**
	Girls.	1488		5.70	0.042	1.62	28.4	5.1	0.97	20.3	6.24	+0.54
Eight	**Boys.**	**1882**	"	**8.76**	**0.048**	**2.08**	**23.2**	**7.4**	**1.61**	**22.5**	**8.74**	**—0.02**
	Girls.	1882		7.52	0.046	2.00	26 6	6.4	1.82	31.9	7.30	—0.22
Nine	**Boys.**	**2007**	"	**10.43**	**0.059**	**2.66**	**25.5**	**8.4**	**1.67**	**19.1**	**10.24**	**—0.19**
	Girls.	1828		8.47	0.049	2.10	24.8	6.9	0.95	12.6	8.29	—0.18
Ten	**Boys.**	**1886**	"	**11.72**	**0.059**	**2.57**	**21.9**	**9.1**	**1.29**	**12.4**	**11.59**	**—0.13**
	Girls.	1798		9.38	0.053	2.23	23.8	7.3	0.91	10.7	9.97	—0.59
Eleven	**Boys.**	**1650**	"	**13.49**	**0.067**	**2.70**	**20.0**	**10.1**	**1.77**	**15.1**	**13.26**	**—0.23**
	Girls.	1616		11.07	0.059	2.36	21.3	8.3	1.69	18.0	11.09	+0.02
Twelve	**Boys.**	**1502**	"	**15.37**	**0.080**	**3.11**	**20.2**	**11.1**	**1.88**	**13.9**	**15.08**	**—0.29**
	Girls.	1554		12.60	0.076	2.98	23.7	9.1	1.53	13.8	12.65	+0.05
Thirteen	**Boys.**	**1148**	"	**17.31**	**0.103**	**3.50**	**20.2**	**12.1**	**1.94**	**12.6**	**16.95**	**—0.36**
	Girls.	1257		14.83	0.094	3.35	22.6	10.1	2.23	17.7	14.71	—0.12
Fourteen	**Boys.**	**854**	"	**20.27**	**0.134**	**3.93**	**19.4**	**13.6**	**2.96**	**17.5**	**19.77**	**—0.50**
	Girls.	947		17.13	0.127	3.90	22.7	11.4	2.30	15.5	16.44	—0.69
Fifteen	**Boys.**	**439**	"	**23.94**	**0.243**	**5.10**	**21.3**	**15.4**	**3.67**	**18.1**	**24.04**	**+0.08**
	Girls.	618		18.23	0.154	3.84	21.1	11.8	1.10	6.4	18.64	+0.41
Sixteen	**Boys.**	**162**	"	**27.25**	**0.438**	**5.58**	**20.5**	**17.0**	**3.31**	**13.8**	**27.79**	**+0.54**
	Girls.	359		19.86	0 207	3.93	19.8	12.6	1.63	8.9	19.78	—0.08
Seventeen	**Boys.**	**58**	"	**29.58**	**0.639**	**4.87**	**16.5**	**17.9**	**2.33**	**8.6**	**30.18**	**+0.60**
	Girls.	144		20.10	0.264	3.17	15.8	12.6	0.24	12.1	20.00	—0.10
Eighteen	Girls.	75	"	23.48				14.8	3.38	16.8	23.50	+0.02
Nineteen	Girls.	53	"	20.79				13.1			21.17	+0.38
Twenty	Girls.	62	"	22.19				13.9			22.67	+0.48
Twenty-one	Girls.	33	"	23.28							23.00	—0.28

TABLE No. 45.

THE STRENGTH OF SQUEEZE, RIGHT HAND.

AGE AT NEAREST BIRTHDAY.	Sex.	Unit of Measurement.	Dynamometers A. & D.				Dynamometer B.				Dynamometers C. & E.			
			No. of Observations.	Average.	Median.	Probable Deviation	No. of Observations.	Average.	Median.	Probable Deviation	No. of Observations.	Average.	Median.	Probable Deviation
Six	**Boys.**	Kilo-gram.	**159**	**5.25**	**5.74**	**1.24**	**198**	**10.25**	**10.61**	**2.04**	**269**	**16.03**	**15.82**	**4.08**
	Girls.		197	4.25	5.32	1.29	201	8.68	9.53	2.21	289	13.91	15.80	3.60
Seven	**Boys.**	"	**436**	**7.26**	**7.24**	**1.86**	**427**	**12.29**	**11.85**	**1.32**	**688**	**19.67**	**20.24**	**4.52**
	Girls.		377	6.35	6.49	1.85	395	10.18	10.62	2.11	721	16.64	15.88	4.47
Eight	**Boys.**	"	**744**	**9.85**	**10.21**	**2.47**	**377**	**14.15**	**14.70**	**2.84**	**759**	**22.87**	**22.72**	**4.44**
	Girls.		746	8.15	8.57	2.41	393	12.22	12.30	2.57	734	20.67	20.53	3.85
Nine	**Boys.**	"	**877**	**12.29**	**11.25**	**3.10**	**351**	**16.47**	**15.95**	**3.33**	**774**	**27.77**	**26.00**	**5.25**
	Girls.		829	9.39	9.28	2.70	328	13.33	13.33	2.92	672	24.17	23.78	5.62
Ten	**Boys.**	"	**941**	**13.65**	**12.89**	**3.23**	**363**	**18.94**	**20.02**	**3.57**	**574**	**31.50**	**30.59**	**6.11**
	Girls.		847	10.81	10.64	2.52	395	15.21	15.57	3.13	559	26.48	25.65	5.59
Eleven	**Boys.**	"	**823**	**14.64**	**15.20**	**3.05**	**340**	**21.99**	**20.96**	**4.04**	**481**	**35.63**	**35.26**	**6.40**
	Girls.		761	11.92	11.72	2.46	373	17.53	18.62	3.82	479	30.36	30.38	5.78
Twelve	**Boys.**	"	**678**	**17.24**	**16.98**	**3.36**	**347**	**25.90**	**25.75**	**4.93**	**481**	**40.35**	**40.16**	**7.43**
	Girls.		730	13.71	13.81	3.01	313	20.46	20.64	3.95	510	33.60	32.61	7.27
Thirteen	**Boys.**	"	**534**	**18.82**	**19.11**	**3.75**	**257**	**30.36**	**30.47**	**5.60**	**361**	**46.22**	**45.42**	**9.14**
	Girls.		575	16.52	15.96	3.41	261	24.97	25.15	4.72	420	39.38	35.96	8 55
Fourteen	**Boys.**	"	**399**	**22.61**	**22.28**	**4.12**	**189**	**36.26**	**35.52**	**6.97**	**260**	**51.83**	**50.74**	**9.65**
	Girls.		491	18.63	18.55	4.20	171	28.27	28.92	5.92	288	42.98	40.45	10.60
Fifteen	**Boys.**	"	**249**	**27.23**	**26.79**	**5.39**	**79**	**41.68**	**40.88**	**7.46**	**119**	**64.85**	**63.36**	**1.27**
	Girls.		343	19.88	20.37	3.30	87	32.45	32.50	5.78	187	48.11	49.10	9.90
Sixteen	**Boys.**	"	**102**	**30.42**	**30.55**	**5.29**	**31**	**43.32**	**41.85**	**13.59**	**30**	**86.40**	**80.00**	**1.37**
	Girls.		219	20.81	20.90	3.30	43	37.00	36.50	6.17	94	51.48	51.00	10.08
Seventeen	**Boys.**	"	**21**	**37.38**	**30.70**									
	Girls.		112	21.88	22.25	3.78								
Eighteen	Girls.	"	75	24.13	24.88	4.82								
Nineteen	Girls.	"	53	21.82	22.25	3.27								
Twenty	Girls.	"	61	22.92	22.81	2.19								
'enty-one	Girls.	"	38		24.00									

TABLE No. 38.

The Height Standing.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%		%				
Six..................	Boys.	**709**	Centimetr's	**108.94**	**0.128**	**3.40**	**3.1**			**105.99**	**109.23**	**112.69**	**+0.29**
	Girls.	780		107.67	0.123	3.42	3.2			104.74	108 10	111.30	+0.43
Seven...............	Boys.	**1850**	"	**114.03**	**0.084**	**3.61**	**3.2**	**5.08**	**4.7**	**111.02**	**114.48**	**118.02**	**+0.45**
	Girls.	1791		112.95	0.089	3.75	3.3	5.28	4.9	109.72	113.44	117.07	+0.49
Eight................	Boys.	**2228**	"	**119.13**	**0.082**	**3.89**	**3.3**	**5.10**	**4.7**	**116.03**	**119.77**	**123.58**	**+0.64**
	Girls.	2193		118.36	0.079	3.70	3.1	5.41	4.8	115.07	118.74	122.35	+0.38
Nine.................	Boys.	**2205**	"	**124.35**	**0.080**	**3.75**	**3.0**	**5.22**	**4.4**	**121.09**	**124.87**	**128.76**	**+0.52**
	Girls.	2122		123.67	0.83	3.83	3.1	5.31	4.5	120.90	124.11	127.58	+0.44
Ten..................	Boys.	**2087**	"	**128.87**	**0.087**	**3.98**	**3.1**	**4.52**	**3.6**	**125.49**	**129.45**	**133.54**	**+0.68**
	Girls.	2053		128.43	0.089	4.06	3.1	4.76	3.9	124.96	128.85	132.58	+0.42
Eleven..............	Boys.	**1819**	"	**133.84**	**0.099**	**4.23**	**3.2**	**4.97**	**3.9**	**130.03**	**134.44**	**138.29**	**+0.60**
	Girls.	1772		133.19	0.106	4.48	3.2	4.76	3.7	129.23	133.60	137.97	+0.41
Twelve........... ...	Boys.	**1658**	"	**138.21**	**0.116**	**4.47**	**3.2**	**4.37**	**3.3**	**134.25**	**138.57**	**142.99**	**+0.36**
	Girls.	1732		139.11	0.098	5.28	3.4	5.92	4.4	134.61	139.54	144.44	+0.43
Thirteen.............	Boys.	**1268**	"	**142.91**	**0.140**	**4.98**	**3.5**	**4.70**	**3.4**	**138.45**	**143.29**	**148.28**	**+0.38**
	Girls.	1322		146.53	0.150	5.46	3.8	7.42	5.3	140.98	146.19	151.79	−0.34
Fourteen.............	Boys.	**925**	"	**148.58**	**0.183**	**5.58**	**3.8**	**5.67**	**4.0**	**143.43**	**148.86**	**154.52**	**+0.28**
	Girls.	1085		150.84	0.156	5.15	3.7	4.31	2.9	146.85	151.94	156.32	+1.10
Fifteen..............	Boys.	**490**	"	**154.90**	**0.286**	**6.33**	**4.1**	**6.32**	**4.3**	**148.88**	**155.25**	**161.86**	**+0.35**
	Girls.	680		155.04	0.154	4.01	3.4	4.20	2.8	151.75	155.82	159.58	+0.78
Sixteen..............	Boys.	**189**	"	**160.27**	**0.427**	**5.87**	**3.7**	**5.37**	**3.5**	**155.28**	**161.27**	**167.04**	**+1.00**
	Girls.	420		157.52	0.197	4.05	2.6	2.48	1.6	153.94	158.03	161.81	+0.51
Seventeen............	Boys.	**78**	"	**165.13**	**0.592**	**5.15**	**3.1**	**4.86**	**3.0**	**160.79**	**166.00**	**171.84**	**+0.87**
	Girls.	206		159.33	0.241	3.45	2.2	1.81	1.1	155.65	159.40	162.93	+0.07
Eighteen.............	Boys.	**29**	"	**170.41**	**0.924**	**4.98**	**2.8**	**5.28**	**3.2**		**170.50**		**+0.09**
	Girls.	164		159.42	0.265	3.39	2.1	0.09	0.06	156.40	159.50	163.29	+0.08
Nineteen.............	Girls.	85	"	158.46	0.438	4.04	2.6			154.32	159.56	163.27	+1.10
Twenty...............	Girls.	79	"	159.41	0.358	3.08	2.0				159.83		+0.42
Twenty-one..........	Girls.	48	"	159.98	0.651	4.27	2.7				160.50		+0.52

TABLE No. 39.

THE WEIGHT.

AGE AT NEAREST BIRTHDAY.	SEX.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E*	Probable Deviation *d*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	**Boys.**	**707**	Kilogram.	**19.75**	**0.054**	**1.43**	**7.2**	**18.1**			**18.57**	**19.85**	**21.27**	**+0.10**
	Girls.	798		18.93	0.051	1.44	7.6	17.6			17.70	18.99	20.44	+0.06
Seven	**Boys.**	**1814**	"	**21.67**	**0.039**	**1.68**	**7.8**	**19.0**	**1.92**	**9.7**	**20.14**	**21.66**	**23.36**	**—0.01**
	Girls.	1714		20.82	0.045	1.88	9.0	18.4	1.89	10.0	19.25	20.81	22.55	—0.01
Eight	**Boys.**	**2188**	"	**23.78**	**0.042**	**1.96**	**8.2**	**20.0**	**2.11**	**9.7**	**22.00**	**23.87**	**25.86**	**+0.09**
	Girls.	2147		22.88	0.042	1.95	8.5	19.3	2.06	9.9	21.02	22.85	24.75	—0.03
Nine	**Boys.**	**2188**	"	**26.06**	**0.045**	**2.09**	**8.0**	**21.0**	**2.28**	**9.6**	**24.17**	**26.22**	**28.28**	**+0.16**
	Girls.	2055		25.08	0.049	2.23	8.9	20.3	2.20	9.6	23.07	25.04	27.31	—0.04
Ten	**Boys.**	**2064**	"	**28.32**	**0.049**	**2.23**	**7.9**	**22.0**	**2.26**	**8.7**	**26.07**	**28.36**	**30.81**	**+0.04**
	Girls.	1947		27.49	0.052	2.31	8.4	21.4	2.41	9.6	25.08	27.45	29.96	—0.04
Eleven	**Boys.**	**1748**	"	**31.00**	**0.062**	**2.60**	**8.4**	**23.2**	**2.68**	**9.5**	**28.50**	**31.08**	**33.66**	**+0.08**
	Girls.	1708		30.15	0.070	2.91	9.6	22.6	2.66	9.7	27.28	29.80	32.84	—0.35
Twelve	**Boys.**	**1644**	"	**33.51**	**0.061**	**2.46**	**7.3**	**24.2**	**2.51**	**8.1**	**30.65**	**33.41**	**36.26**	**—0.10**
	Girls.	1676		33.66	0.081	3.31	9.8	24.2	3.51	11.6	30.05	33.25	36.83	—0.41
Thirteen	**Boys.**	**1242**	"	**36.61**	**0.110**	**3.88**	**10.6**	**25.6**	**3.10**	**9.3**	**32.88**	**36.25**	**39.86**	**—0.36**
	Girls.	1343		38.49	0.115	4.22	11.0	26.3	4.83	14.3	33.86	38.00	42.79	—0.49
Fourteen	**Boys.**	**946**	"	**40.44**	**0.148**	**4.56**	**11.3**	**27.2**	**3.83**	**10.5**	**36.41**	**39.98**	**45.38**	**—0.46**
	Girls.	1082		42.29	0.142	4.67	11.0	28.0	3.80	9.9	37.87	42.65	47.55	+0.36
Fifteen	**Boys.**	**498**	"	**46.22**	**0.227**	**5.06**	**11.0**	**29.8**	**5.78**	**14.3**	**40.04**	**45.49**	**51.75**	**—0.73**
	Girls.	690		46.69	0.154	4.05	8.7	30.1	4.40	10.4	42.59	46.85	50.66	+0.16
Sixteen	**Boys.**	**203**	"	**51.60**	**0.431**	**6.16**	**12.0**	**32.0**	**5.38**	**11.6**	**45.66**	**51.88**	**57.99**	**+0.28**
	Girls.	420		50.25	0.207	4.24	8.4	31.9	3.56	7.6	46.56	49.96	54.96	—0.29
Seventeen	**Boys.**	**71**	"	**55.67**	**0.521**	**4.38**	**7.9**	**33.7**	**4.07**	**7.9**	**51.94**	**55.31**	**61.21**	**—0.36**
	Girls.	230		52.61	0.244	3.70	7.0	33.0	2.36	4.7	48.67	52.52	56.47	—0.09
Eighteen	Girls.	155	"	52.36	0.289	3.60	6.9	33.0			49.27	53.10	56.83	+0.74
Nineteen	Girls.	81	"	52.19	0.332	3.76	7.2	32.8			48.98	52.47	55.74	+0.28
Twenty	Girls.	66	"	53.91	0.565	3.76	7.0	33.7			50.01	53.57	57.33	—0.34

TABLE No. 40.

The Height Sitting.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	Boys.	714	Centimetr's	61.31	0.105	2.82	4.6	56.3			59.11	60.77	63.02	−0.54
	Girls.	751		59.45	0.132	2.03	3.4	55.2			58.23	60.11	62.05	+0.66
Seven	Boys.	1853	"	63.32	0.061	2.64	4.2	55.5	2.01	3.3	61.16	63.22	65.22	−0.10
	Girls.	1727		61.80	0.053	2.19	3.5	54.7	2.45	4.1	60.53	62.44	64.56	+0.64
Eight	Boys.	2289	"	64.74	0.048	2.26	3.5	54.4	1.42	2.2	63.22	65.21	67.17	+0.47
	Girls.	2120		63.97	0.044	2.04	3.2	54.0	2.17	3.5	62.71	64.96	66.87	+0.99
Nine	Boys.	2258	"	66.73	0.049	2.34	3.5	53.7	1.99	3.1	65.05	67.08	69.32	+0.35
	Girls.	2071		66.16	0.046	2.11	3.2	53.5	2.19	3.4	64.73	66.19	68.82	+0.03
Ten	Boys.	2118	"	69.25	0.040	2.42	3.5	53.7	2.52	3.8	66.90	69.18	71.35	−0.07
	Girls.	2037		68.19	0.049	2.19	3.2	53.1	2.03	3.1	66.72	68.88	70.99	+0.69
Eleven	Boys.	1828	"	70.67	0.060	2.56	3.6	52.8	1.42	2.1	68.73	71.00	73.23	+0.43
	Girls.	1748		70.03	0.057	2.37	3.4	52.6	1.84	2.7	67.06	70.62	72.94	+0.59
Twelve	Boys.	1656	"	72.55	0.067	2.72	3.8	52.5	1.88	2.7	70.49	72.68	75.08	+0.13
	Girls.	1707		72.67	0.068	2.61	3.6	52.2	2.64	3.8	70.69	73.22	75.78	+0.55
Thirteen	Boys.	1285	"	74.20	0.076	2.74	3.7	51.9	1.65	2.3	72.08	74.49	76.88	+0.29
	Girls.	1354		76.03	0.078	2.87	3.8	51.9	3.36	4.6	73.78	76.52	79.44	+0.49
Fourteen	Boys.	936	"	76.84	0.103	3.15	4.1	51.7	2.64	3.6	74.37	76.71	79.37	−0.13
	Girls.	1065		78.68	0.095	3.11	4.0	52.2	2.65	3.5	76.50	79.61	82.28	+0.93
Fifteen	Boys.	498	"	79.74	0.161	3.59	4.5	51.5	2.90	3.8	76.51	79.67	83.73	−0.07
	Girls.	674		81.42	0.098	2.54	3.1	52.5	2.74	3.5	79.76	82.20	84.58	+0.78
Sixteen	Boys.	193	"	82.28	0.250	3.48	4.2	51.3	2.54	3.2	79.37	83.22	86.32	+0.94
	Girls.	411		83.76	0.116	2.36	2.8	53.2	2.34	2.9	82.16	84.50	86.52	+0.74
Seventeen	Boys.	77	"	85.68	0.427	3.77	4.4	51.9	3.40	4.1	83.35	86.62	89.55	+0.94
	Girls.	202		84.66	0.153	2.17	2.6	53.2	0.90	1.1	83.00	85.41	87.30	+0.75
Eighteen	Boys.	31	"	88.23	0.536	2.89	3.3	51.7	2.55	3.1	85.86	87.70	92.39	−0.53
	Girls.	167		85.20	0.133	1.72	2.0	53.7	0.54	0.6	84.26	85.89	87.56	+0.69
Nineteen	Girls.	85		84.86	0.198	1.82	2.1	53.3			83.96	85.68	87.27	+0.82
Twenty	Girls.	78		85.31	0.230	2.03	2.4	53.3			84.15	86.00	88.08	+0.69
Twenty-one	Girls.	41		85.05	0.290	1.86	2.2					85.79		+0.74

TABLE No. 41.

The Span of Arms.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observa-tions.	Unit of Measure-ment.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percen-tile Grade.	Median or 50 Percen-tile Grade.	75 Percen-tile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	**Boys.**	**708**	Centimetre.	**108.95**	**1.044**	**3.85**	**3.5**	**100.0**			**105.66**	**109.57**	**113.60**	**+0.62**
	Girls.	769		106.96	0.140	3.87	3.6	99.4			104.18	107.29	111.41	+0.33
Seven	**Boys.**	**1862**	“	**114.42**	**0.096**	**4.16**	**3.6**	**100.3**	**5.47**	**5.0**	**111.09**	**115.08**	**118.87**	**+0.66**
	Girls.	1724		112.36	0.107	4.18	3.7	99.5	5.40	5.0	108.76	113.11	117.27	+0.75
Eight	**Boys.**	**2234**	“	**120.07**	**0.088**	**4.18**	**3.5**	**100.8**	**5.65**	**4.9**	**116.52**	**120.73**	**124.71**	**+0.66**
	Girls.	2152		118.33	0.092	4.28	3.6	100.0	5.97	5.3	114.70	118.13	122.58	—0.20
Nine	**Boys.**	**2272**	“	**125.18**	**0.089**	**4.25**	**3.4**	**100.7**	**5.11**	**4.3**	**121.55**	**125.67**	**129.98**	**+0.49**
	Girls.	2065		123.63	0.092	4.18	3.4	100.0	5.30	4.5	120.15	124.28	128.42	+0.65
Ten	**Boys.**	**2076**	“	**130.22**	**0.103**	**4.70**	**3.6**	**101.0**	**5.04**	**4.0**	**126.19**	**130.61**	**135.49**	**+0.39**
	Girls.	2045		128.75	0.104	4.69	3.6	100.2	5.12	4.1	124.63	129.18	133.74	+0.43
Eleven	**Boys.**	**1810**	“	**135.13**	**0.113**	**4.84**	**3.6**	**100.9**	**4.91**	**3.8**	**130.89**	**135.59**	**140.57**	**+0.46**
	Girls.	1757		134.24	0.116	4.87	3.6	100.8	5.49	4.3	129.42	134.56	139.48	+0.22
Twelve	**Boys.**	**1664**	“	**140.60**	**0.112**	**4.57**	**3.2**	**101.7**	**5.47**	**4.1**	**135.55**	**140.48**	**145.43**	**—0.12**
	Girls.	1718		140.07	0.109	4.51	3.2	100.7	5.83	4.3	135.12	140.60	146.05	+0.53
Thirteen	**Boys.**	**1281**	“	**145.09**	**0.159**	**5.71**	**3.9**	**101.5**	**4.49**	**3.2**	**140.08**	**145.33**	**151.37**	**+0.24**
	Girls.	1368		147.19	0.150	5.55	3.8	100.5	7.12	5.1	142.10	147.83	153.39	+0.64
Fourteen	**Boys.**	**934**	“	**151.28**	**0.197**	**6.03**	**4.0**	**101.8**	**6.19**	**4.3**	**146.00**	**151.62**	**157.36**	**+0.34**
	Girls.	1088		152.58	0.160	5.29	3.5	101.2	5.39	3.7	148.30	153.56	158.54	+0.98
Fifteen	**Boys.**	**495**	“	**158.43**	**0.321**	**7.15**	**4.5**	**102.3**	**7.15**	**4.7**	**151.81**	**158.79**	**166.04**	**+0.36**
	Girls.	677		156.38	0.176	4.58	2.9	100.9	3.80	2.5	152.62	156.21	161.41	—0.17
Sixteen	**Boys.**	**189**	“	**163.96**	**0.574**	**7.89**	**4.8**	**102.3**	**5.53**	**3.5**	**158.04**	**165.31**	**171.49**	**+1.35**
	Girls.	413		158.51	0.217	4.41	2.8	100.7	2.13	1.4	155.39	159.31	163.26	+0.80
Seventeen	**Boys.**	**75**	“	**168.56**	**0.581**	**5.03**	**3.0**	**102.1**	**4.60**	**2.8**	**164.77**	**169.58**	**175.38**	**+1.02**
	Girls.	202		159.01	0.285	4.05	2.5	102.1	0.50	3.2	155.36	159.62	163.45	+0.61
Eighteen	**Boys.**	**32**	“	**175.31**	**0.761**	**4.31**	**2.5**	**102.9**	**6.75**	**4.0**	**171.14**	**175.50**	**179.94**	**+0.19**
	Girls.	164		160.47	0.334	4.28	2.7	101.3	1.46	0.9	156.65	161.38	165.41	+0.91
Nineteen	Girls.	83	“	158.45	0.517	4.71	2.9	101.8			155.17	158.90	163.09	+0.45
Twenty	Girls.	76	“	160.17	0.474	4.18	2.6	100.1			156.45	161.50	164.98	+1.33
Twenty-one ..	Girls.	37	“	161.27	0.712	4.33	2.7	100.1			157.40	160.88	166.68	—0.39

TABLE No. 42.

The Girth of Chest Midway Between Inspiration and Expiration.*

Age at Nearest Birthday.	Sex.	Number of Individuals.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Av'age. d/A	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six	Boys. Girls.	677 [illegible]	Centim.	59.05 58.34	0.053 0.059	2.22 2.45	3.8 4.3	54.2 54.2			57.45 56.81	59.32 58.87	61.42 60.98	+0.27 +0.53
Seven	Boys. Girls.	1705 [illegible]	"	60.62 59.47	0.057 0.062	2.35 2.47	3.9 4.2	53.1 52.7	1.57 1.13	2.7 1.9	58.79 57.65	60.89 59.87	63.25 62.31	+0.63 +0.40
Eight	Boys. Girls.	[illegible] [illegible]	"	62.18 60.81	0.052 0.053	2.35 2.40	3.8 3.9	52.2 51.3	1.56 1.34	2.6 2.3	60.49 58.94	62.55 61.84	65.18 63.80	+0.37 +0.53
Nine	Boys. Girls.	2120 [illegible]	"	63.90 62.51	0.055 0.057	2.51 2.53	3.9 4.0	51.4 50.6	1.72 1.70	2.8 2.8	61.97 60.65	64.38 63.03	66.91 65.60	+0.48 +0.52
Ten	Boys. Girls.	1997 [illegible]	"	65.59 63.02	0.061 0.061	2.72 2.67	4.1 4.2	50.9 49.1	1.69 0.51	2.6 0.8	63.49 61.18	65.92 64.46	68.64 67.16	+0.33 +0.45
Eleven	Boys. Girls.	1782 1654	"	67.24 65.85	0.063 0.075	2.61 3.04	3.9 4.6	50.2 49.4	1.65 2.83	2.5 4.5	65.29 63.38	67.68 66.36	70.82 69.12	+0.44 +0.52
Twelve	Boys. Girls.	1565 1624	"	68.76 68.34	0.074 0.081	2.94 3.24	4.3 4.7	49.8 49.1	1.52 2.49	2.3 3.8	66.58 65.67	69.17 68.49	72.06 72.04	+0.41 +0.16
Thirteen	Boys. Girls.	1228 1318	"	70.61 71.29	0.089 0.098	3.11 3.54	4.4 5.0	49.4 48.6	1.85 2.95	2.7 4.3	68.09 68.82	71.01 71.64	74.18 75.18	+0.40 +0.35
Fourteen	Boys. Girls.	925 1020	"	73.27 74.18	0.118 0.114	3.58 3.65	4.9 4.9	49.3 49.5	2.66 2.84	3.8 4.0	70.24 71.08	73.38 74.59	77.27 78.29	+0.11 +0.46
Fifteen	Boys. Girls.	498 659	"	76.56 76.78	0.169 0.143	3.77 3.70	4.9 4.7	49.4 50.1	3.29 2.65	4.5 3.6	73.25 73.67	76.94 76.92	80.82 81.15	+0.38 +0.15
Sixteen	Boys. Girls.	205 397	"	79.22 78.85	0.298 0.164	4.19 3.27	5.3 4.1	49.4 50.5	2.66 2.07	3.5 2.7	75.61 75.98	79.90 79.22	83.71 82.85	+0.68 +0.37
Seventeen	Boys. Girls.	80 206	"	81.39 80.39	0.353 0.233	3.15 3.34	3.9 4.2	49.3 50.8	2.17 1.54	2.7 2.0	78.90 77.58	82.20 80.72	85.77 84.13	+0.81 +0.34
Eighteen	Boys. Girls.	81 162	"	84.52 80.45	0.528 0.254	2.94 3.23	3.5 4.0	49.6 49.7	3.13 0.06	3.8 0.1	82.69 77.68	85.35 80.92	88.88 84.90	+0.83 +0.47
Nineteen	Girls.	82	"	79.10	0.380	3.43	4.3	50.3			76.61	79.81	82.84	+0.71
Twenty......	Girls.	66	"	80.54	0.339	2.76	3.4				78.20	81.04	83.99	+0.61
Twenty-one ..	Girls.	32	"	81.51	0.521	2.82	3.5				78.63	81.49	84.99	—0.03

* Obtained by adding the Girth of Chest at full Inspiration to the Girth of Chest at full Expiration and dividing by 2.

TABLE No. 43.

THE STRENGTH OF SQUEEZE, RIGHT HAND.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'age. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	Median or 50 Percentile Grade.	Median Minus Average.
					±	±	%	%		%		
Six	**Boys.**	**626**	Kilogram.	**6.09**	**0.056**	**1.41**	**23.2**	**5.6**			**6.30**	+0.21
	Girls.	687		5.14	0.053	1.39	27.0	4.8			5.93	+0.79
Seven	**Boys.**	**1551**	"	**7.69**	**0.039**	**1.52**	**19.8**	**6.7**	**1.60**	**26.2**	**7.67**	**—0.02**
	Girls.	1493		6.53	0.043	1.67	25.6	5.8	1.39	27.0	6.56	+0.03
Eight	**Boys.**	**1880**	"	**9.38**	**0.045**	**1.95**	**20.8**	**7.9**	**1.69**	**22.0**	**9.59**	**+0.21**
	Girls.	1878		8.11	0.043	1.87	23.1	6.9	1.58	24.2	8.24	+0.13
Nine	**Boys.**	**2002**	"	**11.35**	**0.055**	**2.45**	**21.6**	**9.1**	**1.97**	**21.0**	**10.65**	**—0.70**
	Girls.	1829		9.23	0.049	2.11	22.9	7.5	1.12	13.8	9.14	—0.09
Ten	**Boys.**	**1878**	"	**12.83**	**0.061**	**2.66**	**20.7**	**10.0**	**1.48**	**13.0**	**12.72**	**—0.11**
	Girls.	1801		10.42	0.053	2.27	21.9	8.1	1.19	12.9	10.36	—0.06
Eleven	**Boys.**	**1644**	"	**14.37**	**0 068**	**2.74**	**19.1**	**10.7**	**1.54**	**12.0**	**14.29**	**—0.08**
	Girls.	1613		11.80	0.060	2.42	20.5	8.9	1.36	13.1	12.07	+0.27
Twelve	**Boys.**	**1506**	"	**16.70**	**0.082**	**3.17**	**18.8**	**12.1**	**2.33**	**16.2**	**16.56**	**—0.14**
	Girls.	1553		13.46	0.072	2.83	21.0	9.7	1.66	14.1	13.89	—0.07
Thirteen	**Boys.**	**1152**	"	**19.08**	**0.126**	**4.27**	**22.4**	**13.3**	**2.38**	**14.2**	**18.99**	**—0.09**
	Girls.	1256		16.13	0.093	3.31	20.5	11.0	2.67	19.8	15.51	—0.62
Fourteen	**Boys.**	**848**	"	**22.32**	**0.143**	**4.15**	**18.6**	**15.0**	**3.24**	**17.0**	**21.82**	**—0.50**
	Girls.	950		18.02	0.133	4.11	22.8	12.0	1.89	11.7	17.78	—0.24
Fifteen	**Boys.**	**447**	"	**26.69**	**0.244**	**5.10**	**19.1**	**17.2**	**4.37**	**19.6**	**26.17**	**—0.52**
	Girls.	617		20.01	0.147	3.65	18.2	12.9	1.99	11.0	20.32	+0.31
Sixteen	**Boys.**	**168**	"	**31.04**	**0.414**	**5.29**	**17.0**	**19.4**	**4.35**	**16.3**	**29.90**	**—1.14**
	Girls.	356		21.78	0.200	3.77	17.3	13.8	1.77	8.8	21.60	—0.18
Seventeen	**Boys.**	**21**	"		**0.458**						**30.70**	
	Girls.	112		21.88				13.7	0.10	4.6	22.25	+0.37
Eighteen	Girls.	75	"	24.13				15.2	2.25	10.0	24.88	+0.75
Nineteen	Girls.	53	"	21.82				13.7			22.25	+0.43
Twenty	Girls.	61	"	22.92				14.3			22.81	—0.11
Twenty-one	Girls.	38	"								24.00	

TABLE No. 44.

The Strength of Squeeze, Left Hand.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation toAv'age. d/A	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	Median or 50 Percentile Grade.	Median Minus Average.
					±	±	%	%		%		
Six	**Boys.**	**629**	Kilogram.	**5.59**	**0.057**	**1.43**	**25.6**	**5.1**			**6.12**	**+0.53**
	Girls.	686		4.77	0.056	1.47	30.8	4.4			5.46	+0.69
Seven	**Boys.**	**1550**	"	**7.15**	**0.044**	**1.72**	**24.1**	**6.3**	**1.56**	**27.9**	**7.11**	**—0.04**
	Girls.	1488		5.70	0.042	1.62	28.4	5.1	0.97	20.3	6.24	+0.54
Eight	**Boys.**	**1882**	"	**8.76**	**0.048**	**2.08**	**23.2**	**7.4**	**1.61**	**22.5**	**8.74**	**—0.02**
	Girls.	1882		7.52	0.046	2.00	26 6	6.4	1.82	31.9	7.30	—0.22
Nine	**Boys.**	**2007**	"	**10.43**	**0.059**	**2.66**	**25.5**	**8.4**	**1.67**	**19.1**	**10.24**	**—0.19**
	Girls.	1828		8.47	0.049	2.10	24.8	6.9	0.95	12.6	8.29	—0.18
Ten	**Boys.**	**1886**	"	**11.72**	**0.059**	**2.57**	**21.9**	**9.1**	**1.29**	**12.4**	**11.59**	**—0.13**
	Girls.	1798		9.38	0.053	2.23	23.8	7.3	0.91	10.7	9.97	—0.59
Eleven	**Boys.**	**1650**	"	**13.49**	**0.067**	**2.70**	**20.0**	**10.1**	**1.77**	**15.1**	**13.26**	**—0.23**
	Girls.	1616		11.07	0.059	2.36	21.3	8.3	1.69	18.0	11.09	+0.02
Twelve	**Boys.**	**1502**	"	**15.37**	**0.080**	**3.11**	**20.2**	**11.1**	**1.88**	**13.9**	**15.08**	**—0.29**
	Girls.	1554		12.60	0.076	2.98	23.7	9.1	1.53	13.8	12.65	+0.05
Thirteen	**Boys.**	**1148**	"	**17.31**	**0.103**	**3.50**	**20.2**	**12.1**	**1.94**	**12.6**	**16.95**	**—0.36**
	Girls.	1257		14.83	0.094	3.35	22.6	10.1	2.23	17.7	14 71	—0.12
Fourteen	**Boys.**	**854**	"	**20.27**	**0.134**	**3.93**	**19.4**	**13.6**	**2.96**	**17.5**	**19.77**	**—0.50**
	Girls.	947		17.13	0.127	3.90	22.7	11.4	2.30	15.5	16.44	—0.69
Fifteen	**Boys.**	**439**	"	**23.94**	**0.243**	**5.10**	**21.3**	**15.4**	**3.67**	**18.1**	**24.04**	**+0.08**
	Girls.	618		18.23	0.154	3.84	21.1	11.8	1.10	6.4	18.64	+0.41
Sixteen	**Boys.**	**162**	"	**27.25**	**0.438**	**5.58**	**20.5**	**17.0**	**3.31**	**13.8**	**27.79**	**+0.54**
	Girls.	359		19.86	0 207	3.93	19.8	12.6	1.63	8.9	19.78	—0.08
Seventeen	**Boys.**	**58**	"	**29.58**	**0.639**	**4.87**	**16.5**	**17.9**	**2.33**	**8.6**	**30.18**	**+0.60**
	Girls.	144		20.10	0.264	3.17	15.8	12.6	0.24	12.1	20.00	—0.10
Eighteen	Girls.	75	"	23.48				14.8	3.38	16.8	23.50	+0.02
Nineteen	Girls.	53	"	20.79				13.1			21.17	+0.38
Twenty	Girls.	62	"	22.19				13.9			22.67	+0.48
Twenty-one	Girls.	33	"	23.28							23.00	—0.28

TABLE No. 45.

THE STRENGTH OF SQUEEZE, RIGHT HAND.

AGE AT NEAREST BIRTHDAY.	Sex.	Unit of Measurement.	Dynamometers A. & D.				Dynamometer B.				Dynamometers C. & E.			
			No. of Observations.	Average.	Median.	Probable Deviation	No. of Observations.	Average.	Median.	Probable Deviation	No. of Observations.	Average.	Median.	Probable Deviation
Six..........	**Boys.**	Kilogram.	**159**	**5.25**	**5.74**	**1.24**	**198**	**10.25**	**10.61**	**2.04**	**269**	**16.08**	**15.82**	**4.08**
	Girls.		197	4.25	5.32	1.29	201	8.68	9.53	2.21	289	13.91	15.80	3.60
Seven.........	**Boys.**	"	**486**	**7.26**	**7.24**	**1.86**	**427**	**12.29**	**11.85**	**1.32**	**688**	**19.67**	**20.24**	**4.52**
	Girls.		377	6.35	6.49	1.85	395	10.18	10.62	2.11	721	16.64	15.88	4.47
Eight.........	**Boys.**	"	**744**	**9.85**	**10.21**	**2.47**	**377**	**14.15**	**14.70**	**2.84**	**759**	**22.87**	**22.72**	**4.44**
	Girls.		746	8.15	8.57	2.41	393	12.22	12.80	2.57	734	20.67	20.53	3.85
Nine..........	**Boys.**	"	**877**	**12.29**	**11.25**	**3.10**	**351**	**16.47**	**15.95**	**3.33**	**774**	**27.77**	**26.00**	**5.25**
	Girls.		829	9.39	9.28	2.70	328	13.33	13.33	2.92	672	24.17	23.78	5.62
Ten..........	**Boys.**	"	**941**	**13.65**	**12.89**	**3.28**	**363**	**18.94**	**20.02**	**3.57**	**574**	**31.50**	**30.59**	**6.11**
	Girls.		847	10.81	10.64	2.52	395	15.21	15.57	3.13	559	26.48	25.65	5.59
Eleven........	**Boys.**	"	**823**	**14.64**	**15.20**	**3.05**	**340**	**21.99**	**20.96**	**4.04**	**481**	**35.68**	**35.26**	**6.40**
	Girls.		761	11.92	11.72	2.46	378	17.58	18.62	3.82	479	30.36	30.38	5.78
Twelve........	**Boys.**	"	**678**	**17.24**	**16.98**	**3.36**	**347**	**25.90**	**25.75**	**4.93**	**481**	**40.35**	**40.16**	**7.48**
	Girls.		730	13.71	13.81	3.01	313	20.46	20.64	3.95	510	33.60	32.61	7.27
Thirteen......	**Boys.**	"	**534**	**18.82**	**19.11**	**3.75**	**257**	**30.86**	**30.47**	**5.60**	**361**	**46.22**	**45.42**	**9.14**
	Girls.		575	16.52	15.96	3.41	261	24.97	25.15	4.72	420	39.38	35.96	8 55
Fourteen......	**Boys.**	"	**390**	**22.61**	**22.28**	**4.12**	**189**	**36.26**	**35.52**	**6.97**	**260**	**51.88**	**50.74**	**9.65**
	Girls.		491	18.63	18.55	4.20	171	28.27	28.92	5.92	288	42.98	40.45	10.60
Fifteen.......	**Boys.**	"	**249**	**27.23**	**26.79**	**5.39**	**79**	**41.68**	**40.88**	**7.46**	**119**	**64.85**	**63.36**	**1.27**
	Girls.		343	19.88	20.37	3.30	87	32.45	32.50	5.78	187	48.11	49.10	9.90
Sixteen......	**Boys.**	"	**102**	**30.42**	**30.55**	**5.29**	**31**	**43.82**	**41.85**	**13.59**	**30**	**86.40**	**80.00**	**1.37**
	Girls.		219	20.81	20.90	3.30	43	37.00	36.50	6.17	94	51.48	51.00	10.08
Seventeen	**Boys.**	"	**21**	**37.38**	**30.70**									
	Girls.		112	21.88	22.25	3.78								
Eighteen......	Girls.	"	75	24.13	24.88	4.82								
Nineteen......	Girls	"	53	21.82	22.25	3.27								
Twenty.......	Girls.	"	61	22.92	22.81	2.19								
Twenty-one ..	Girls.	"	38		24.00									

TABLE No. 46.

THE STRENGTH OF SQUEEZE, LEFT HAND.

AGE AT NEAREST BIRTHDAY.	Sex.	Unit of Measurement.	Dynamometers A. & D.				Dynamometer B.				Dynamometers C. & K.			
			No. of Observations.	Average.	Median	Probable Deviation.	No. of Observations.	Average.	Median	Probable Deviation.	No. of Observations.	Average.	Median	Probable Deviation.
Six	Boys. Girls.	Kilogram.	158 196	4.80 3.77	5.57 5.00	1.48 1.49	198 202	9.39 8.12	10.28 8.72	2.11 2.05	278 288	14.77 13.24	15.38 14.37	3.72 3.35
Seven	Boys. Girls.	"	440 376	6.75 5.53	7.02 5.87	1.72 1.57	428 393	11.26 8.42	10.96 10.85	2.38 2.50	687 719	18.56 15.80	18.09 15.47	4.74 4.06
Eight	Boys. Girls.	"	741 745	9.27 7.90	9.39 7.49	2.64 2.48	379 404	13.10 10.88	13.10 10.77	2.54 2.26	762 783	21.35 19.08	20.96 18.62	4.77 5.18
Nine	Boys. Girls.	"	876 830	11.14 8.44	10.68 8.54	3.06 2.48	361 328	16.11 12.80	15.22 12.27	3.09 2.72	780 670	25.94 22.20	25.48 20.97	7.15 5.14
Ten	Boys. Girls.	"	947 847	12.31 10.06	11.62 10.80	3.14 2.64	365 392	17.26 14.15	17.21 14.76	3.65 3.08	574 559	29.25 24.82	30.08 25.14	5.58 5.04
Eleven	Boys. Girls.	"	824 762	14.04 10.95	13.66 10.81	3.20 2.54	338 374	19.94 16.52	20.25 16.57	3.97 3.62	488 480	33.87 28.00	32.60 29.29	5.88 5.41
Twelve	Boys. Girls.	"	678 782	15.86 12.71	15.61 12.60	3.20 3.30	348 310	23.65 18.80	23.71 20.22	5.24 4.16	481 512	37.47 32.84	35.84 30.78	6.86 7.24
Thirteen	Boys. Girls.	"	585 574	17.47 15.25	17.82 15.24	3.69 3.48	258 261	27.39 23.09	26.88 23.05	5.52 5.26	355 422	41.98 35.82	40.58 35.08	8.05 7.80
Fourteen	Boys. Girls.	"	402 490	20.46 17.13	20.68 17.06	3.90 3.92	191 171	32.66 26.31	31.44 26.00	5.96 4.98	261 286	48.27 43.18	45.90 38.75	10.01 11.20
Fifteen	Boys. Girls.	"	247 348	24.89 18.05	24.69 18.25	4.74 3.45	69 87	40.12 28.89	39.50 30.32	8.42 6.26	123 188	54.08 44.99	55.00 45.29	12.74 10.00
Sixteen	Boys. Girls.	"	101 221	28.17 19.84	29.50 19.29	4.91 3.24	30 42	40.33 31.74	39.75 32.75	10.17 5.35	81 96	63.52 49.41	70.20 47.40	13.15 12.56
Seventeen	Boys. Girls.	"	36 112	30.97 19.79	31.67 19.40	4.87 3.24					22 32	68.77 49.78	70.00 50.25	11.79 7.54
Eighteen	Girls.	"	75	23.48	23.50	5.05								
Nineteen	Girls.	"	53	20.79	21.17	3.40								
Twenty	Girls.	"	62	22.19	22.67	2.23								
Twenty-one	Girls.	"	88	23.28	23.00	2.88								

TABLE No. 47.

The Length of Head.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations	Unit of Measurement	Average.	Probable Error of Average. *E.*	Probable Deviation. *d.*	Relation of Probable Deviation to Av'rage. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
					±	±	%	%		%				
Six...........	**Boys.**	**606**	Millimetre.	**178.39**	**0.171**	**4.21**	**2.36**	**16.4**			**174.63**	**178.86**	**182.79**	**+0.47**
	Girls.	606		173.45	0.170	4.20	2.42	16.1			170.19	174.34	178.14	+0.89
Seven....	**Boys.**	**1493**	"	**178.54**	**0.118**	**4.57**	**2.56**	**15.7**	**0.15**	**0.08**	**174.84**	**179.92**	**183.79**	**+0.38**
	Girls.	1511		174.09	0.108	4.22	2.42	15.4	0.64	0.37	171.41	175.58	179.76	+0.49
Eight.........	**Boys.**	**2079**	"	**179.62**	**0.106**	**4.85**	**2.70**	**15.1**	**1.08**	**0.60**	**176.03**	**180.44**	**184.87**	**+0.82**
	Girls.	2125		175.18	0.092	4.26	2.43	14.8	1.09	0.63	172.17	176.41	180.82	+1.23
Nine..........	**Boys.**	**1986**	"	**180.72**	**0.109**	**4.87**	**2.69**	**14.5**	**1.10**	**0.61**	**176.71**	**181.00**	**185.69**	**+0.28**
	Girls.	1884		176.39	0.101	4.39	2.49	14.3	1.21	0.69	173 69	177.80	181.68	+1.41
Ten......	**Boys.**	**1912**	"	**181.45**	**0.094**	**4.13**	**2.28**	**14.1**	**0.73**	**0.40**	**178.10**	**181.51**	**185.85**	**+0.06**
	Girls.	1790		177.24	0.102	4.33	2.44	13.8	0.85	0.48	174.15	178.52	182.47	+1.28
Eleven.	**Boys.**	**1654**	"	**182.37**	**0.129**	**5.26**	**2.89**	**13.6**	**0.92**	**0.50**	**178.85**	**182.86**	**187.26**	**+0.49**
	Girls.	1560		178.08	0.119	4.70	2.64	13.4	0.84	0.47	174.71	179.75	183.78	+1.67
Twelve.	**Boys.**	**1576**	"	**182.84**	**0.115**	**4.56**	**2.49**	**13.2**	**0.47**	**0.26**	**179.19**	**183.08**	**187.52**	**+0.24**
	Girls.	1516		179.50	0.114	4.46	2.49	12.9	1.42	0.80	176.43	180.57	184.86	+1.07
Thirteen	**Boys.**	**1207**	"	**183.84**	**0.131**	**4.55**	**2.48**	**12.9**	**1.00**	**0.55**	**179.93**	**184.21**	**188.78**	**+0.37**
	Girls.	1187		181.44	0.132	4.55	2.51	12.4	1.94	1.08	178.35	182.48	187.05	+1.04
Fourteen......	**Boys.**	**890**	"	**186.93**	**0.182**	**5.44**	**2.91**	**12.6**	**3.09**	**1.68**	**182.08**	**186.24**	**190.75**	**—0.69**
	Girls.	1008		183.41	0.143	4.53	2.47	12.2	1.97	1.09	180.07	184.71	188.73	+1.30
Fifteen.	**Boys.**	**502**	"	**187.01**	**0.208**	**4.66**	**2.49**	**12.1**	**0.08**	**0.04**	**183.01**	**187.69**	**191.97**	**+0.68**
	Girls.	649		185.12	0.180	4.58	2.47	11.9	1.71	0.93	181.53	185.67	190.90	+0.55
Sixteen	**Boys.**	**191**	"	**189.06**	**0.355**	**4.93**	**2.61**	**11.8**	**2.05**	**1.10**	**184.79**	**190.04**	**194.77**	**+0.98**
	Girls.	400		186.84	0.256	5.12	2.74	12.1	1.72	0.93	183.02	187.70	192.47	+0.86
Seventeen	**Boys.**	**78**	"	**189.45**	**0.575**	**5.08**	**2.68**	**11.5**	**0.39**	**0.21**		**190.93**		**+1.48**
	Girls.	221		188.14	0.275	4.09	2.17	11.8	1.30	0.70	184.58	188.60	192.60	+0.46
Eighteen	**Boys.**	**32**	"	**193.91**	**0.717**	**4.13**	**2.13**	**11.4**	**4.46**	**2.35**		**193.75**		**—0.16**
	Girls.	161		187.97	0.252	3.20	1.70	11.9			184.79	188.41	191.86	+0.44
Nineteen......	Girls.	77	"	187.91	0.466	4.09	2.18	11.8			184.36	188.31	191.75	+0.40
Twenty	Girls.	75	"	187.81	0.433	3.75	2.01	11.7				188.08		+0.27
Twenty-one ..	Girls.		"											

TABLE No. 48.

The Width of Head.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation. d.	Relation of Probable Deviation to Av'rage. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.	Width / Length Index.
							%	%		%					
Six	**Boys.** Girls.	**578** 609	Millimetre.	**143.29** 140.27	**0.118** 0.154	**2.82** 3.81	**1.97** 2.72	**13.2** 13.0			**140.77** 137.21	**143.76** 140.83	**147.11** 144.54	**+0.47** +0.56	**0.80** 0.81
Seven	**Boys.** Girls.	**1571** 1505	"	**144.37** 141.40	**0.090** 0.099	**3.58** 3.86	**2.48** 2.73	**12.7** 12.5	**1.08** 1.13	**0.75** 0.81	**141.57** 138.63	**144.98** 142.10	**148.26** 145.44	**+0.61** +0.70	**0.81** 0.81
Eight	**Boys.** Girls.	**1994** 1985	"	**145.30** 142.31	**0.082** 0.082	**3.68** 3.66	**2.53** 2.57	**12.2** 12.0	**0.93** 0.91	**0.64** 0.64	**142.37** 139.50	**145.68** 142.84	**149.43** 146.30	**+0.38** +0.53	**0.81** 0.81
Nine	**Boys.** Girls.	**1962** 1914	"	**145.87** 143.04	**0.084** 0.083	**3.74** 3.65	**2.56** 2.55	**11.7** 11.6	**0.57** 0.73	**0.39** 0.51	**142.79** 140.47	**146.08** 143 58	**150.05** 147.01	**+0.21** +0.54	**0.81** 0.81
Ten	**Boys.** Girls.	**1827** 1808	"	**146.59** 143.75	**0.090** 0.093	**3.85** 3.96	**2.63** 2.76	**11.4** 11.2	**0.72** 0.71	**0.49** 0.50	**143.40** 140.99	**147.11** 144.54	**151.02** 148.02	**+0.52** +0.79	**0.81** 0 81
Eleven	**Boys.** Girls.	**1561** 1541	"	**147.29** 145.05	**0.095** 0.097	**3.76** 3.80	**2.55** 2.62	**11.0** 10.9	**0.70** 1.31	**0.48** 0.90	**144.80** 142.06	**147.50** 145.54	**151.42** 149.33	**+0.31** +0.49	**0.81** 0.81
Twelve	**Boys.** Girls.	**1581** 1460	"	**147.98** 145.64	**0.092** 0.105	**3.61** 4.03	**2.44** 2.77	**10.7** 10.5	**0.69** 0.59	**0.47** 0.42	**145.19** 142.91	**148.36** 146.31	**152.08** 150.06	**+0.38** +0.67	**0.81** 0.81
Thirteen	**Boys.** Girls.	**1175** 1167	"	**148.73** 146.78	**0.114** 0.115	**3.90** 3.92	**2.62** 2.67	**10.4** 10.0	**0.75** 1.14	**0.51** 0.78	**145.46** 143.44	**149.01** 147.15	**152.98** 151.17	**+0.27** +0.37	**0.81** 0.81
Fourteen.... ..	**Boys.** Girls.	**878** 927	"	**149.50** 147.90	**0.129** 0.130	**3.82** 3.96	**2.56** 2.68	**10.1** 9.8	**0.77** 1.12	**0.52** 0.76	**146.04** 144.57	**150.04** 148.25	**153.42** 152.14	**+0.54** +0.35	**0.80** 0.81
Fifteen.	**Boys.** Girls.	**469** 658	"	**149.63** 148.29	**0.186** 0.150	**4.03** 3.84	**2.69** 2.59	**9.7** 9.6	**1.13** 0.39	**0.87** 0.26	**146.24** 145.16	**150.41** 148.71	**154.04** 152.63	**+0.78** +0.42	**0.80** 0.80
Sixteen.	**Boys.** Girls.	**195** 395	"	**150.98** 148.95	**0.249** 0.210	**3.48** 4.17	**2.31** 2.80	**9.4** 9.4	**1.35** 0.66	**0.90** 0.44	**147.75** 145.85	**151.85** 149.67	**154.96** 153.44	**+0.87** +0.72	**0.80** 0.80
Seventeen	**Boys.** Girls.	**75** 221	"	**152.09** 150.04	**0.486** 0.242	**4.21** 3.60	**2.77** 2.40	**9.2** 9.4	**1.11** 1.09	**0.74** 0.73	**149.84** 146.99	**152.50** 150.43	**156.55** 154.88	**+0.41** +0.39	**0.80** 0.80
Eighteen......	**Boys.** Girls.	**32** 165	"	**151.66** 149.09	**0.685** 0.300	**3.88** 3.85	**2.56** 2.58	**8.9** 9.4			 145.96	**152.00** 150.16	 153.21	**+0.34** +1.07	**0.78** 0.79
Nineteen......	Girls.	79	"	149.11	0.466	4.14	2.78	9.4			146.08	150.17	154.10	+1.06	0.79
Twenty.......	Girls.	73	"	147.82	0.426	3.64	2.46	9.2			144.69	147.70	152.26	—0.12	0.79
Twenty-one ..	Girls.		"												

TABLE No. 49.

THE HEIGHT OF FACE FROM ROOT OF NOSE TO POINT OF CHIN.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Average. $\frac{d}{A}$	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
							%	%		%				
Six..........	**Boys.**	**604**	**Millimetre.**	**93.72**	**0.207**	**5.09**	**5.23**	**8.6**			**89.24**	**93.20**	**99.45**	**—0.52**
	Girls.	612		91.42	0.194	4.80	5.25	8.5			86.88	90.89	96.46	—0.53
Seven..........	**Boys.**	**1580**	“	**95.87**	**0.120**	**4.80**	**5.06**	**8.4**	**2.15**	**2.89**	**91.28**	**95.57**	**101.11**	**—0.30**
	Girls.	1509		93.77	0.115	4.45	4.75	8.3	2.35	2.57	89.35	93.20	98.38	—0.57
Eight..........	**Boys.**	**2057**	“	**97.98**	**0.108**	**4.67**	**4.77**	**8.2**	**2.11**	**2.20**	**93.73**	**97.78**	**102.71**	**—0.20**
	Girls.	2016		95.65	0.099	4.46	4.66	8.1	1.88	2.01	91.67	95.60	99.79	—0.05
Nine..........	**Boys.**	**2011**	“	**99.51**	**0.107**	**4.82**	**4.84**	**8.0**	**1.53**	**1.56**	**95.04**	**99.42**	**104.25**	**—0.09**
	Girls.	1898		97.85	0.103	4.48	5.76	7.9	2.20	2.30	93.61	97.60	102.31	—0.25
Ten..........	**Boys.**	**1868**	“	**101.06**	**0.110**	**4.77**	**4.72**	**7.7**	**1.55**	**1.56**	**96.66**	**100.78**	**105.93**	**—0.33**
	Girls.	1820		99.39	0.109	4.64	4.67	7.8	1.54	1.57	95.04	99.02	104.22	—0.37
Eleven..........	**Boys.**	**1660**	“	**103.37**	**0.127**	**5.18**	**5.01**	**7.5**	**2.31**	**2.29**	**98.53**	**103.23**	**108.85**	**—0.14**
	Girls.	1572		101.44	0.116	4.61	4.54	7.6	2.05	2.06	97.08	101.20	106.32	—0.24
Twelve..........	**Boys.**	**1568**	“	**104.25**	**0.132**	**5.22**	**5.01**	**7.4**	**0.88**	**0.85**	**99.88**	**104.45**	**109.77**	**+0.20**
	Girls.	1523		103.46	0.129	5.05	4.88	7.4	2.02	1.99	98.81	103.53	108.83	+0.07
Thirteen..........	**Boys.**	**1205**	“	**106.24**	**0.160**	**5.54**	**5.21**	**7.3**	**1.99**	**1.91**	**101.64**	**106.34**	**111.76**	**+0.10**
	Girls.	1231		105.92	0.133	4.68	4.42	7.2	2.46	2.38	101.60	105.71	111.15	—0.21
Fourteen..........	**Boys.**	**893**	“	**108.43**	**0.174**	**5.21**	**4.80**	**7.2**	**2.19**	**2.06**	**103.64**	**108.51**	**113.79**	**+0.08**
	Girls.	997		107.87	0.156	4.94	4.58	7.2	1.95	1.84	103.37	107.72	112.86	—0.15
Fifteen..........	**Boys.**	**479**	“	**111.63**	**0.288**	**5.21**	**4.67**	**7.1**	**3.20**	**2.95**	**106.04**	**111.52**	**116.88**	**—0.11**
	Girls.	672		109.79	0.192	4.98	4.53	7.1	1.92	1.78	104.56	109.40	114.05	—0.39
Sixteen..........	**Boys.**	**191**	“	**113.63**	**0.346**	**4.79**	**4.22**	**7.1**	**2.00**	**1.79**	**109.19**	**113.73**	**118.98**	**+0.10**
	Girls.	403		110.48	0.245	4.91	4.45	7.0	0.69	0.63	105.92	109.83	115.48	—0.61
Seventeen..........	**Boys.**	**78**	“	**117.56**	**0.744**	**6.57**	**5.59**	**7.1**	**3.93**	**3.46**	**112.42**	**118.50**	**122.89**	**+0.94**
	Girls.	223		110.04	0.345	5.15	4.68	6.9			105.11	110.50	115.46	+0.46
Eighteen..........	**Boys.**	**31**	“	**120.84**	**0.888**	**4.92**	**4.16**		**3.28**	**2.79**		**121.00**		**+0.16**
	Girls.	163		109.77	0.297	3.79	3.45	6.9			105.65	110.04	114.06	+0.27
Nineteen..........	Girls	80	“	108.72	0.421	3.77	3.50	6.8			104.18	108.34	112.90	—0.38
Twenty..........	Girls.	78	“	110.26	0.469	4.01	3.64	6.9			106.34	110.30	114.13	+0.04
Twenty-one..........	Girls.	34	“	110.06	0.627	3.66	3.32					110.00		—0.06

TABLE No. 50.

THE WIDTH OF FACE.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. *E.*	Probable Deviation *d.*	Relation of Probable Deviation to Av'rge. *d/A*	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.	Width Height Index.	Width Height (Hair Line) Index.
					±	±	%	%		%						
Six	**Boys.**	**608**	Millimetre.	**117.24**	**0.172**	**4.24**	**3.62**	**10.8**			**114.04**	**118.20**	**121.62**	**+0.96**	**1.25**	**0.77**
	Girls.	608		115.21	0.174	4.30	3.73	10.7			111.92	115.89	119.39	+0.68	1.26	0.77
Seven	**Boys.**	**1637**	"	**117.78**	**0.101**	**4.09**	**3.47**	**10.3**	**0.54**	**0.46**	**114.41**	**118.40**	**121.97**	**+0.62**	**1.23**	**0.76**
	Girls.	1516		116.11	0.101	3.92	3.38	10.3	0.90	0.78	112.95	116.38	120.22	+0.27	1.24	0.76
Eight	**Boys.**	**2062**	"	**118.82**	**0.090**	**4.08**	**3.44**	**10.0**	**1.04**	**0.88**	**115.65**	**119.75**	**122.96**	**+0.93**	**1.21**	**0.75**
	Girls.	2065		117.63	0.087	3.97	3.38	9.9	1.52	1.31	113.62	117.45	120.99	−0.18	1.23	0.76
Nine	**Boys.**	**1927**	"	**119.91**	**0.101**	**4.44**	**3.70**	**9.6**	**1.09**	**0.92**	**116.54**	**120.75**	**124.59**	**+0.84**	**1.21**	**0.75**
	Girls.	1905		118.02	0.092	4.02	3.41	9.5	0.39	0.33	114.59	118.81	122.18	+0.79	1.21	0.75
Ten	**Boys.**	**1922**	"	**121.60**	**0.092**	**4.05**	**3.33**	**9.4**	**1.69**	**1.41**	**118.02**	**121.63**	**125.32**	**+0.03**	**1.20**	**0.75**
	Girls.	1829		119.49	0.127	4.38	3.67	9.3	1.47	1.25	116.19	120.42	124.04	+0.93	1.20	0.75
Eleven	**Boys.**	**1666**	"	**122.73**	**0.108**	**4.52**	**3.68**	**9.2**	**1.13**	**0.93**	**119.44**	**123.22**	**126.89**	**+0.49**	**1.19**	**0.75**
	Girls.	1504		121.24	0.107	4.17	3.44	9.1	1.75	1.46	117.82	121.71	125.33	+0.47	1.20	0.75
Twelve	**Boys.**	**1525**	"	**123.81**	**0.113**	**4.42**	**3.57**	**9.0**	**1.08**	**0.88**	**120.90**	**124.59**	**128.45**	**+0.78**	**1.19**	**0.75**
	Girls.	1526		122.44	0.109	4.26	3.48	8.8	1.20	0.99	119.50	123.07	127.01	+0.63	1.18	0.74
Thirteen	**Boys.**	**1213**	"	**125.83**	**0.122**	**4.27**	**3.39**	**8.8**	**2.02**	**1.63**	**121.96**	**126.02**	**129.79**	**+0.19**	**1.19**	**0.75**
	Girls.	1248		124.15	0.127	4.45	3.59	8.5	1.71	1.40	120.62	124.86	128.82	+0.71	1.17	0.74
Fourteen	**Boys.**	**898**	"	**126.81**	**0.153**	**4.56**	**3.59**	**8.5**	**0.98**	**0.78**	**123.17**	**127.32**	**131.64**	**+0.51**	**1.17**	**0.74**
	Girls.	997		125.67	0.135	4.26	3.39	8.3	1.52	1.22	122.31	126.51	130.49	+0.84	1.16	0.72
Fifteen	**Boys.**	**485**	"	**128.32**	**0.196**	**4.33**	**3.37**	**8.3**	**1.51**	**1.19**	**124.02**	**129.03**	**133.72**	**+0.71**	**1.12**	**0.74**
	Girls.	678		127.85	0.157	4.08	3.19	8.2	2.18	1.73	124.51	128.30	132.02	+0.45	1.16	0.72
Sixteen	**Boys.**	**193**	"	**130.27**	**0.360**	**5.01**	**3.85**	**8.2**	**1.95**	**1.52**	**126.39**	**130.82**	**134.89**	**+0.55**	**1.15**	**0.73**
	Girls.	409		129.47	0.201	4.07	3.14	8.2	1.62	1.26	126.21	130.18	133.60	+0.71	1.17	0.73
Seventeen	**Boys.**	**79**	"	**131.96**	**0.527**	**4.69**	**3.56**	**8.0**	**1.69**	**1.30**		**133.75**		**+1.79**	**1.12**	**0.72**
	Girls.	219		130.63	0.275	4.08	3.12	8.2	1.16	0.90	127.91	131.38	135.00	+0.75	1.19	0.73
Eighteen	**Boys.**	**33**	"	**135.00**	**0.718**	**4.13**	**3.06**		**3.04**	**2.01**		**135.75**		**+0.75**	**1.12**	**0.74**
	Girls.	163		131.42	0.265	3.38	2.57	8.2	0.79	0.60	129.14	131.97	135.09	+0.55	1.20	0.73
Nineteen	Girls.	80	"	130.24	0.420	3.76	2.89	8.3				130.44		+0.20	1.20	0.72
Twenty	Girls.	73	"	130.75	0.419	3.58	2.74	8.2				132.04		+1.29	1.19	0.73
Twenty-one	Girls.	34	"		0.528	3.08		8.2				132.00				

TABLE No. 51.

The Height of Face from Hair-Line to Point of Chin.

AGE AT NEAREST BIRTHDAY.	Sex.	Number of Observations.	Unit of Measurement.	Average.	Probable Error of Average. E.	Probable Deviation d.	Relation of Probable Deviation to Average. d/A	Relation of Average to Height Standing.	Absolute Annual Increase of Average.	Relative Annual Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
							%	%		%				
Six	**Boys.**	**611**	**Millimetre.**	**152.68**	**0.209**	**5.18**	**3.4**	**14.0**			**148.64**	**153.02**	**158.59**	**+0.34**
	Girls.	609		150.16	0.238	5.88	3.9	14.0			144.68	150.45	156.21	+0.39
Seven	**Boys.**	**1621**	"	**154.57**	**0.159**	**6.40**	**4.1**	**13.6**	**1.89**	**1.40**	**150.18**	**155.33**	**160.40**	**+0.76**
	Girls.	1486		153.86	0.137	5.28	3.4	13.6	3.20	2.13	148.73	154.19	159.32	+0.33
Eight	**Boys.**	**2012**	"	**157.50**	**0.122**	**5.46**	**3.5**	**13.2**	**2.93**	**1.86**	**153.04**	**158.04**	**163.10**	**+0.54**
	Girls.	1965		155.19	0.119	5.27	3.4	13.1	1.33	1.19	151.05	155.60	161.11	+0.41
Nine	**Boys.**	**1997**	"	**159.43**	**0.127**	**5.67**	**3.6**	**12.8**	**1.93**	**1.32**	**154.45**	**160.25**	**165.62**	**+0.82**
	Girls.	1989		157.44	0.121	5.38	3.4	12.8	2.25	1.45	152.31	157.76	163.40	+0.32
Ten	**Boys.**	**1909**	"	**161.37**	**0.127**	**5.55**	**3.4**	**12.5**	**1.94**	**1.28**	**156.47**	**161.70**	**167.38**	**+0.33**
	Girls.	1835		160.04	0.131	5.62	3.5	12.5	2.60	1.65	155.36	160.56	166.15	+0.52
Eleven	**Boys.**	**1653**	"	**163.39**	**0.143**	**5.80**	**3.5**	**12.2**	**2.02**	**1.25**	**158.67**	**164.11**	**169.45**	**+0.72**
	Girls.	1581		162.55	0.143	5.70	3.5	12.2	2.51	1.57	157.38	163.40	169.53	+0.85
Twelve	**Boys.**	**1577**	"	**165.23**	**0.137**	**5.44**	**3.3**	**11.9**	**1.84**	**1.22**	**160.87**	**165.62**	**171.54**	**+0.39**
	Girls.	1510		165.29	0.148	5.76	3.5	11.9	2.74	1.69	160.27	165.95	171.40	+0.66
Thirteen	**Boys.**	**1211**	"	**167.62**	**0.173**	**6.01**	**3.6**	**11.7**	**2.39**	**1.20**	**162.59**	**168.16**	**173.87**	**+0.54**
	Girls.	1220		168.35	0.173	6.04	3.6	11.5	3.06	1.85	163.18	169.15	174.85	+0.80
Fourteen	**Boys.**	**896**	"	**170.49**	**0.236**	**7.05**	**4.1**	**11.5**	**2.87**	**1.17**	**165.01**	**171.04**	**177.42**	**+0.55**
	Girls.	998		171.38	0.193	6.11	3.6	11.4	3.03	1.80	163.66	172.00	178.28	+0.62
Fifteen	**Boys.**	**482**	"	**174.30**	**0.292**	**6.41**	**3.7**	**11.3**	**3.81**	**1.15**	**168.74**	**175.08**	**181.23**	**+0.78**
	Girls.	656		174.20	0.211	5.40	3.1	11.2	2.82	1.65	168.92	174.85	180.10	+0.65
Sixteen	**Boys.**	**193**	"	**178.19**	**0.425**	**5.90**	**3.3**	**11.1**	**3.89**	**1.13**	**172.76**	**177.93**	**184.22**	**—0.26**
	Girls.	395		176.28	0.286	5.69	3.2	11.2	2.08	1.19	171.32	176.81	183.09	+0.53
Seventeen	**Boys.**	**79**	"	**182.28**	**0.858**	**7.60**	**4.2**	**11.0**	**4.09**	**1.11**		**182.25**		**—0.03**
	Girls.	201		178.51	0.437	6.20	3.5	11.2	2.23	1.26	173.62	179.41	184.90	+0.90
Eighteen	**Boys.**	**33**	"	**183.67**	**0.139**	**8.00**	**4.4**	**10.8**	**1.39**	**1.10**		**185.66**		**+1.99**
	Girls.	139		180.97	0.520	6.13	3.4	11.4	2.46	1.38	176.32	181.93	186.81	+0.96
Nineteen	Girls.	69	"	181.91	0.749	6.22	3.4	11.4	0.94	0.52	174.29	180.08	185.70	—1.83
Twenty	Girls.	72	"	179.09	0.560	4.76	2.7	11.2			174.80	179.00	184.38	—0.09
Twenty-one	Girls.	33	"	179.97	0.786	4.52	2.5					181.75		+1.78

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CORRIGENDA.

Page 263. Author's name omitted: W. Townsend Porter.
288. Boys, aged 16, hair-line to point of chin should read 0.425 mm.
297. Boys, aged 10, median minus average should read — 0.07 cm.
313. Boys, aged 8, 50 percentile grade should read 119.77 cm.
313. Girls, aged 8, 50 percentile grade should read 118.74 cm.
315. Girls, aged 6, 50 percentile grade should read 107.29 cm.
315. Girls, aged 8, 50 percentile grade should read 118.33 cm.
321. Girls, aged 14, number of observations should read 997.

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III. Median minus average values (chest-girth and strength of squeeze).
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VIII. Girls' height standing (percentile grades).
IX. Boys' height sitting (percentile grades).
X. Girls' height sitting (percentile grades).
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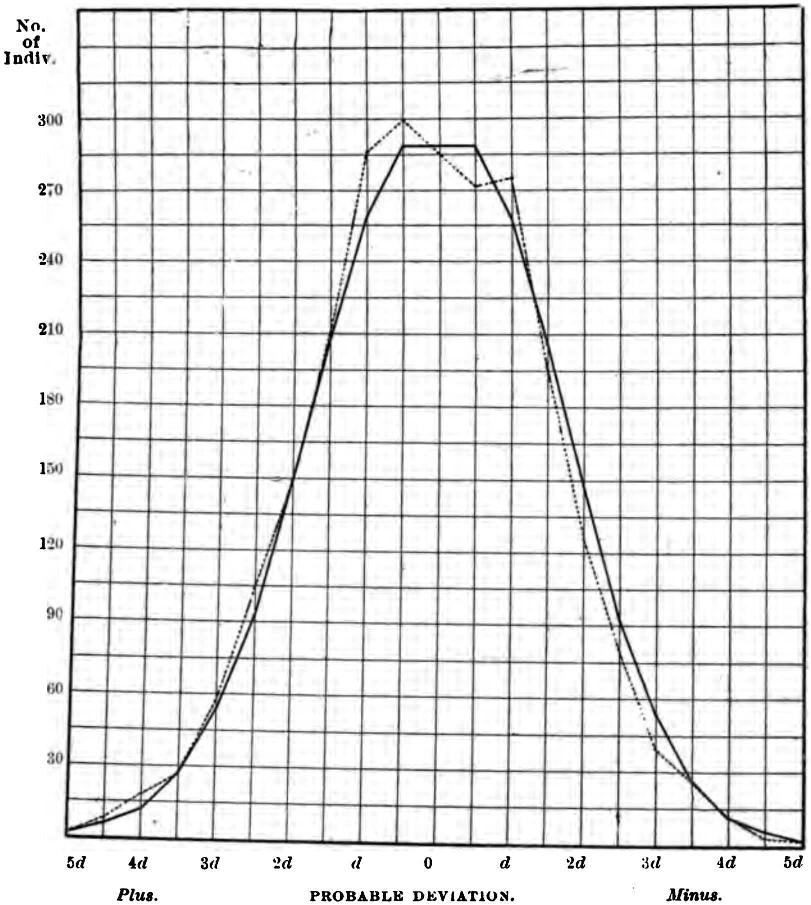
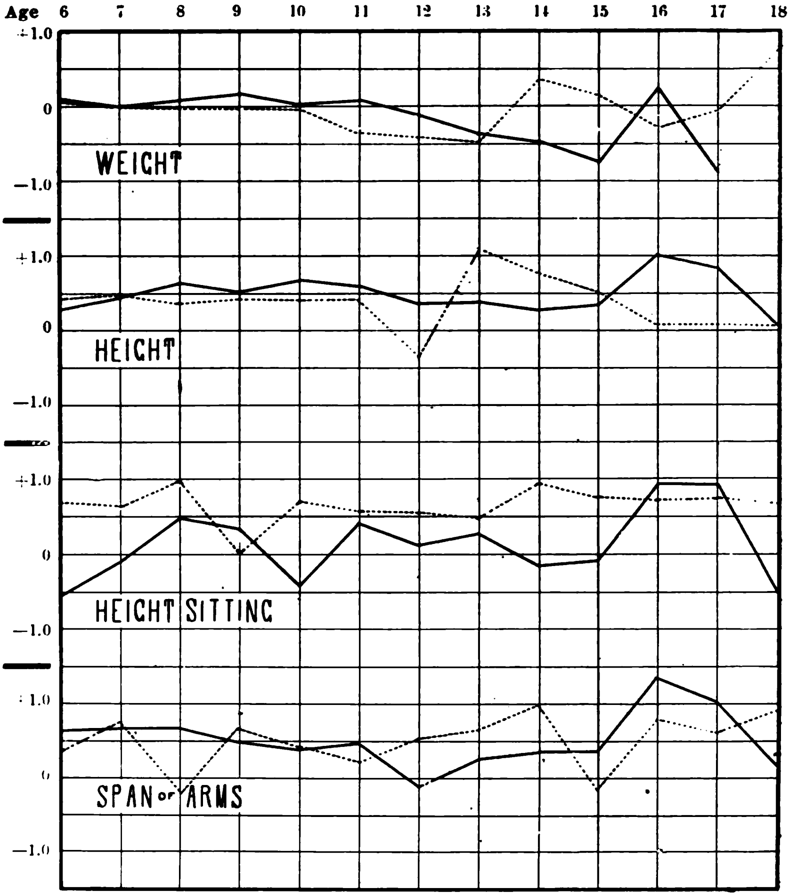


Vol. VI. No. 12. Plate I (from Table No. 7; page 286).

The calculated and the observed distribution of the height standing of 2192 St. Louis School Girls, aged 8.

Unbroken Line:
Distribution according
to theory.

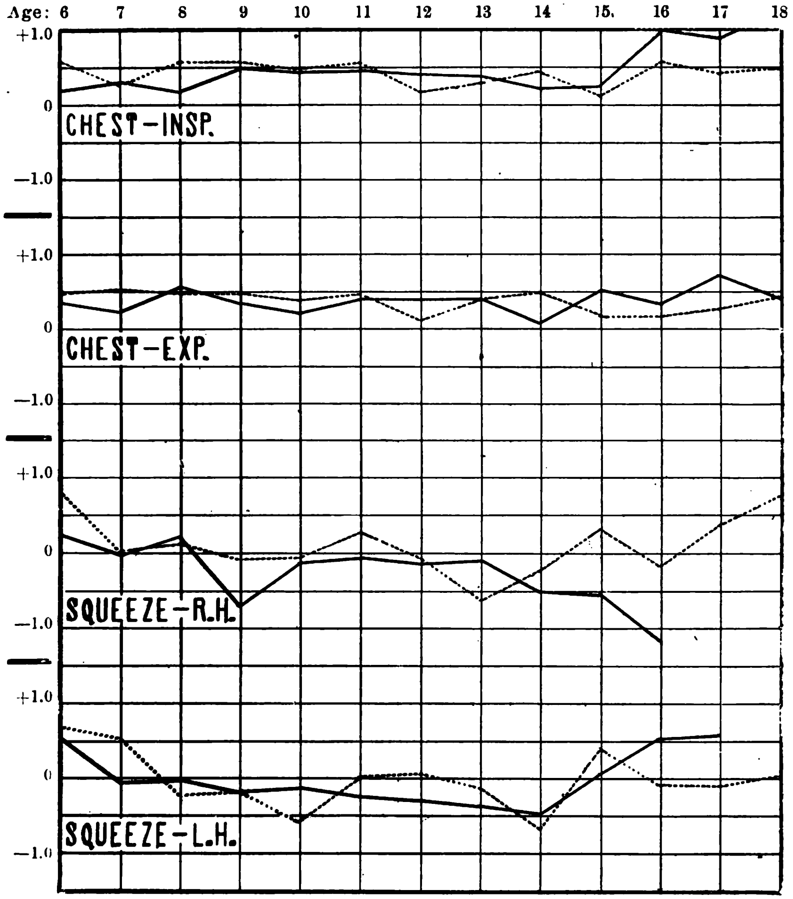
Broken Line:
Distribution according
to observation.



VOL. VI. NO. 12. PLATE II (from Table No. 11; pages 296, 299).

Median Minus Average Values.

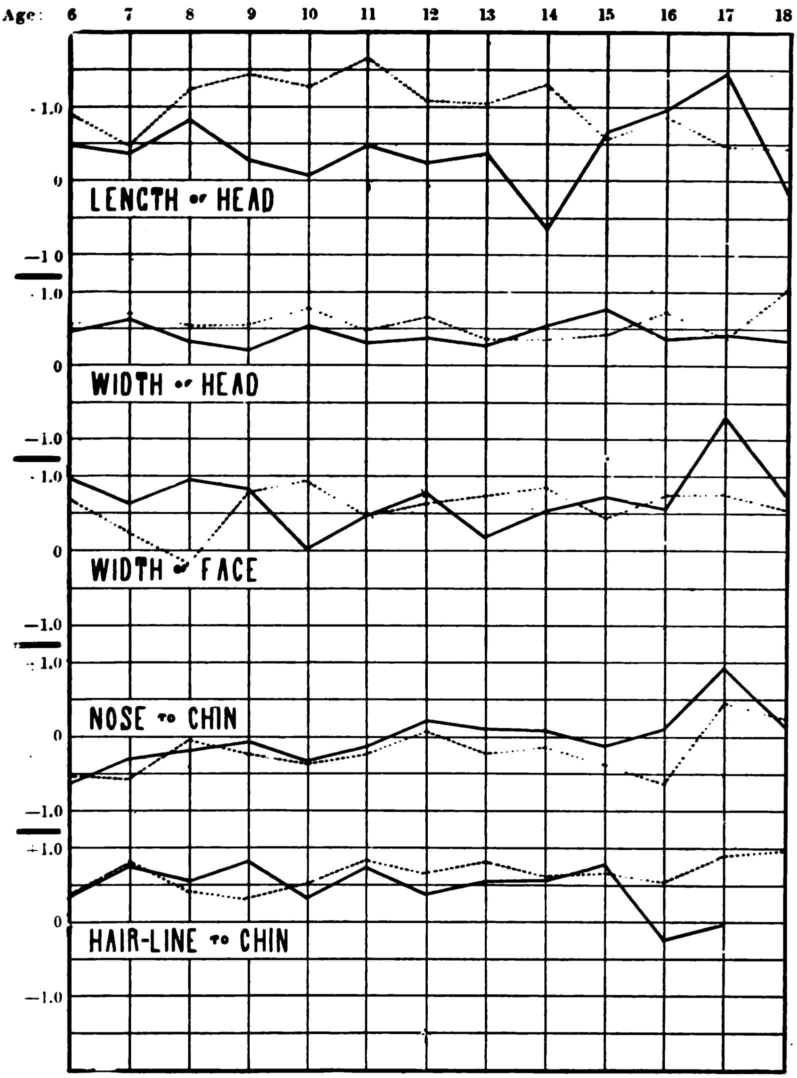
Unbroken Line: Boys. Broken Line: Girls.



VOL. VI. NO. 12. PLATE III (from Table No. 11; pages 296, 299).

Median Minus Average Values.

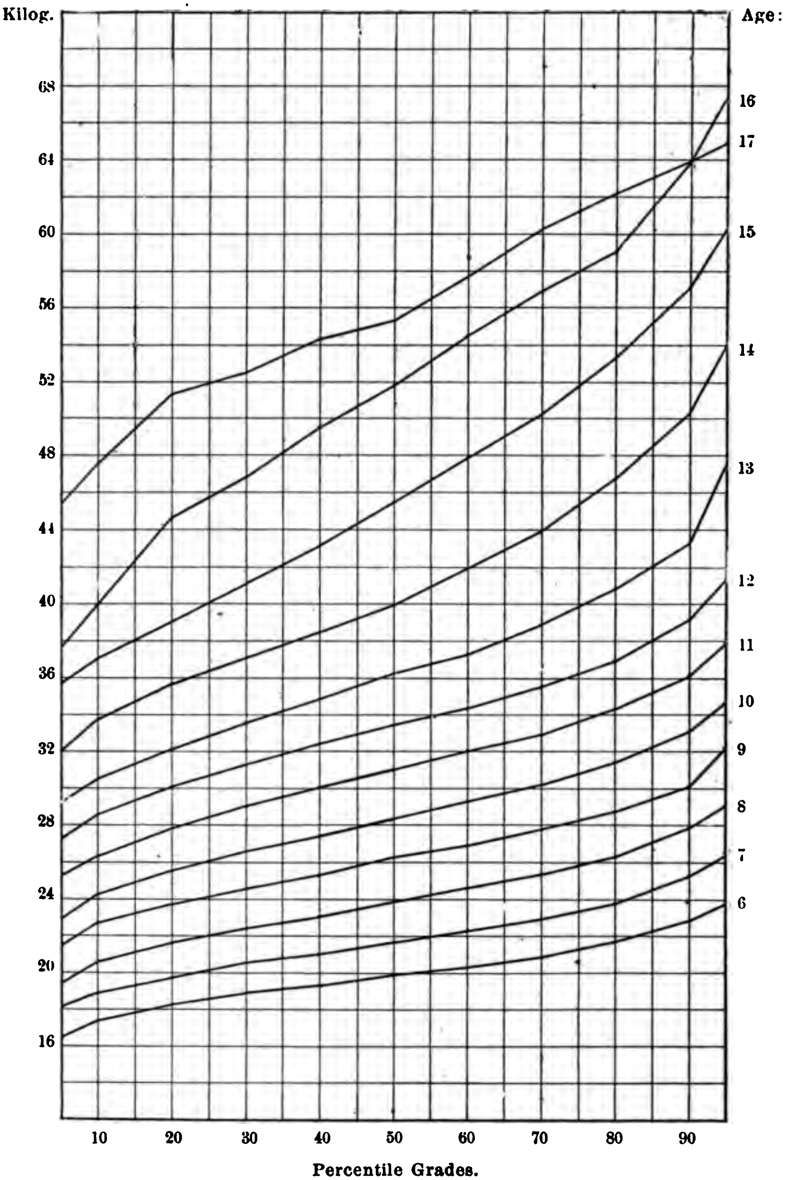
Unbroken Line: Boys. Broken Line: Girls.



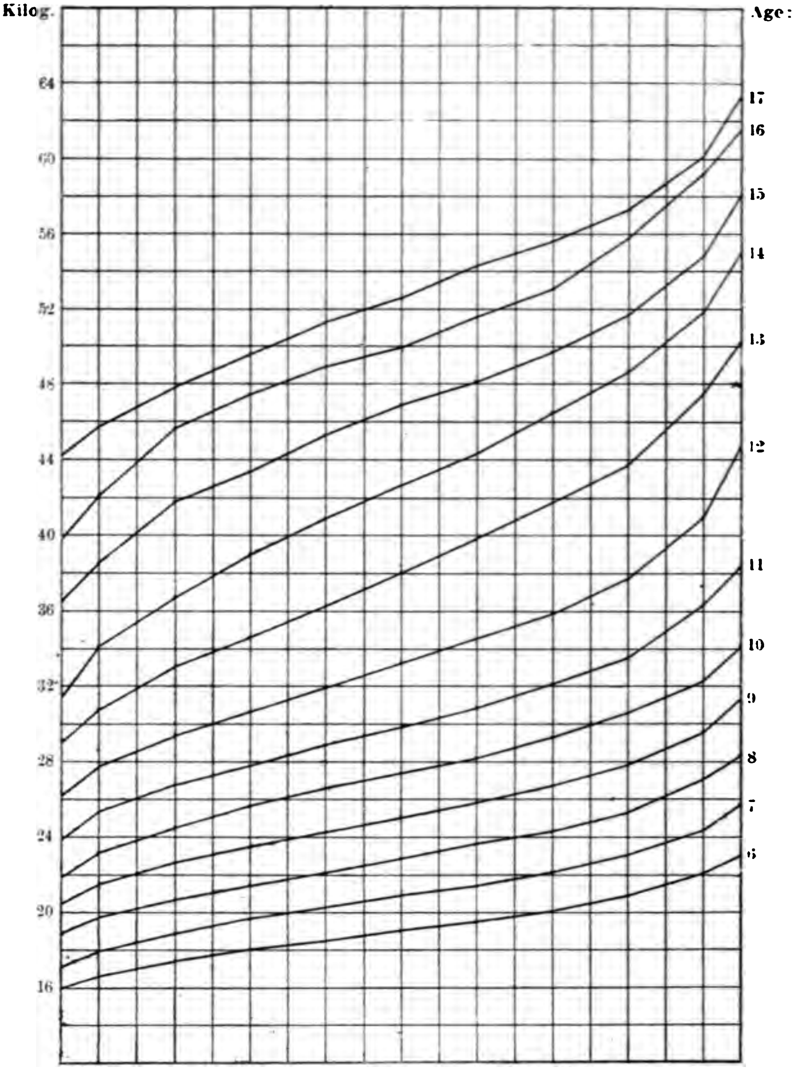
VOL. VI. NO. 12. PLATE IV (from Table No. 11; pages 296, 299).

Median Minus Average Values.

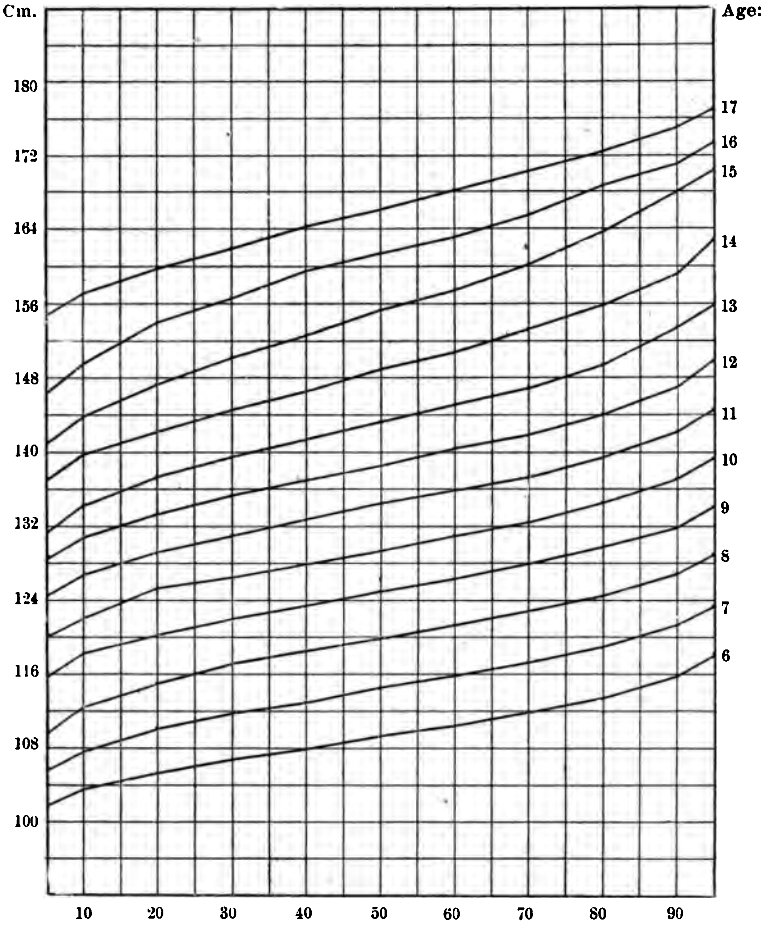
Unbroken Line: Boys. Broken Line: Girls.



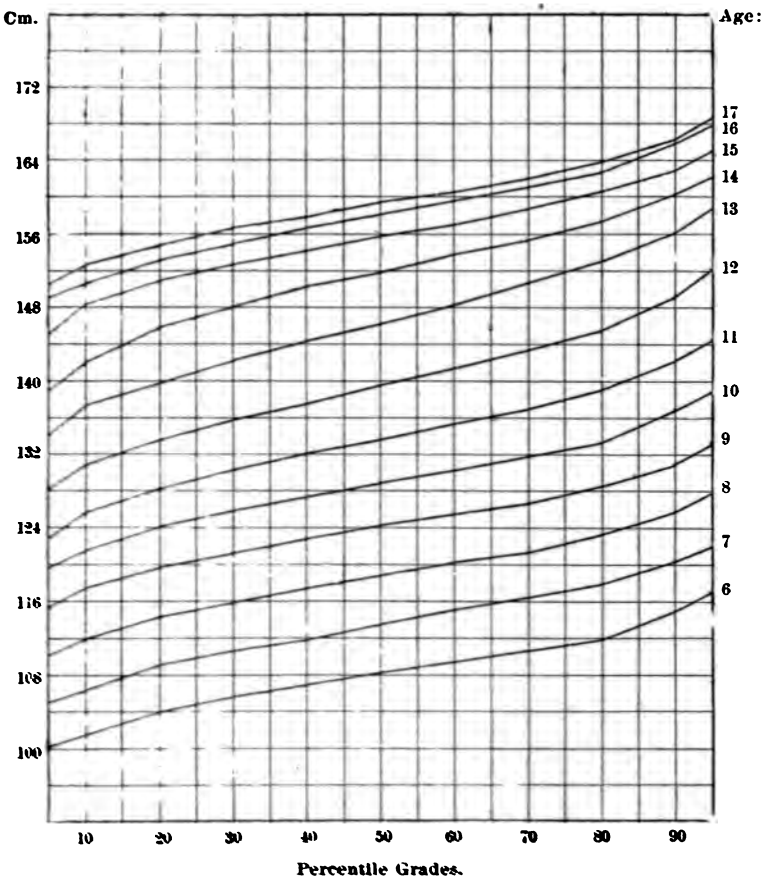
VOL. VI. NO. 12. PLATE V (from Table No. 17; pages 311, 312).
Boys' Weight.



VOL. VI. NO. 12. PLATE VI (from Table No. 17; pages 311, 312).
Girls' Weight.

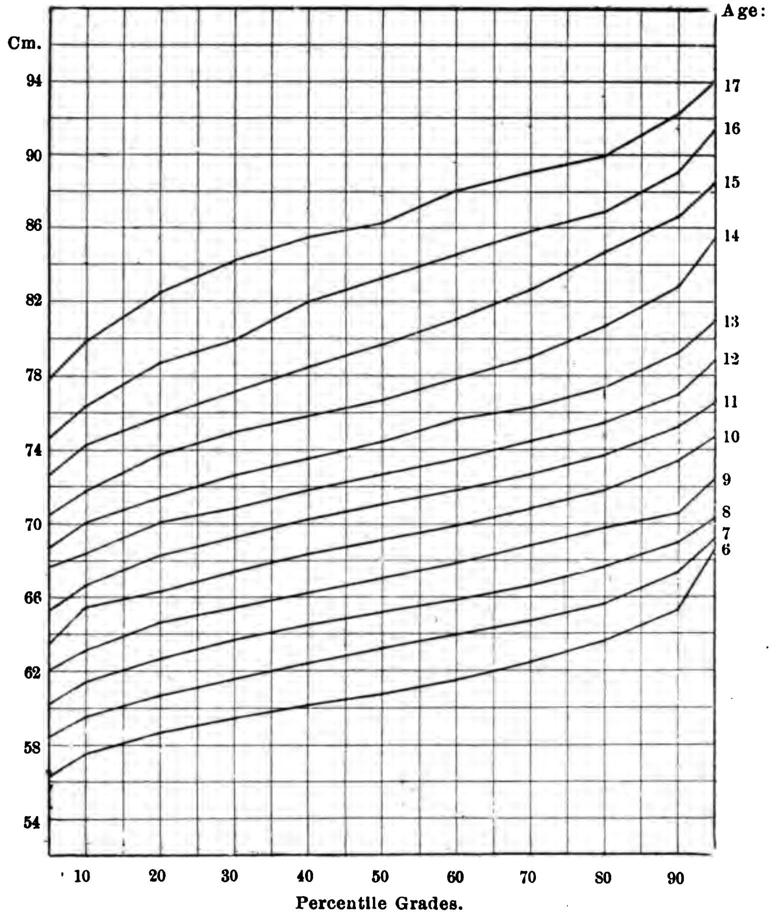


VOL. VI. NO. 12. PLATE VII (from Table No. 18; pages 311, 313).
Boys' Height Standing.



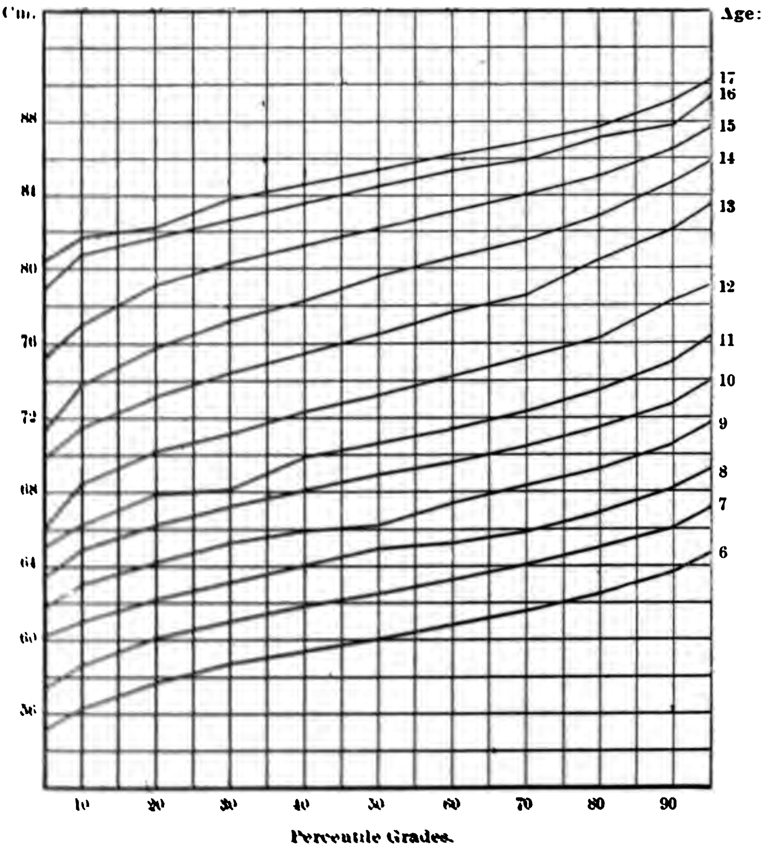
VOL. VI. NO. 12. PLATE VIII (from Table No. 18; pages 311, 313).

Girls' Height Standing.



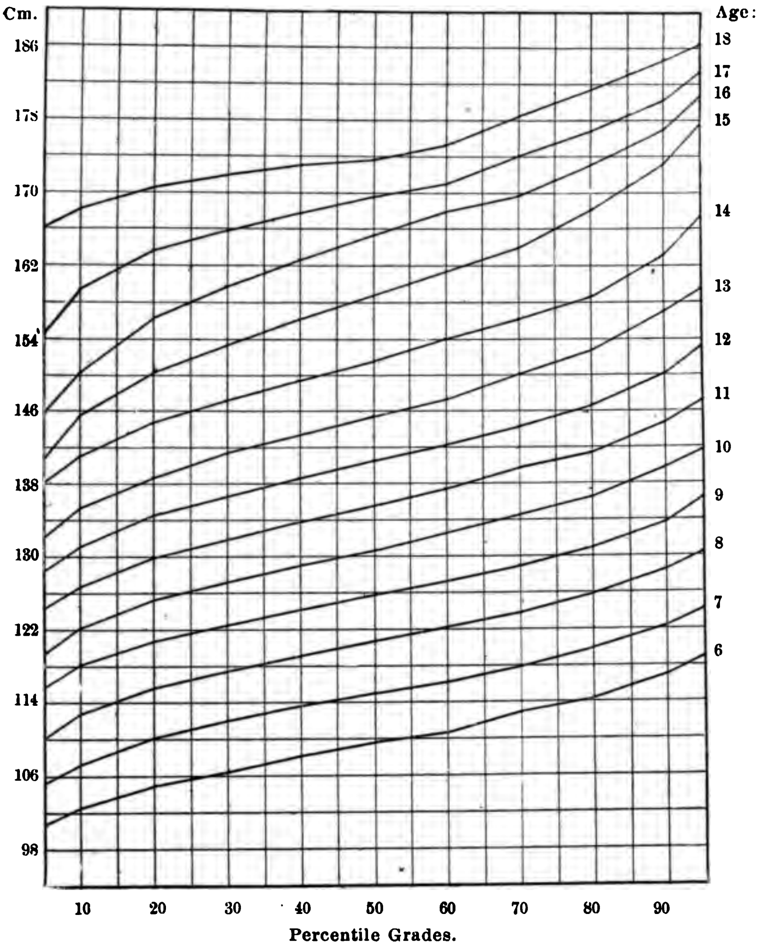
VOL. VI. NO. 12. PLATE IX (from Table No. 19; pages 311, 314).

Boys' Height Sitting.



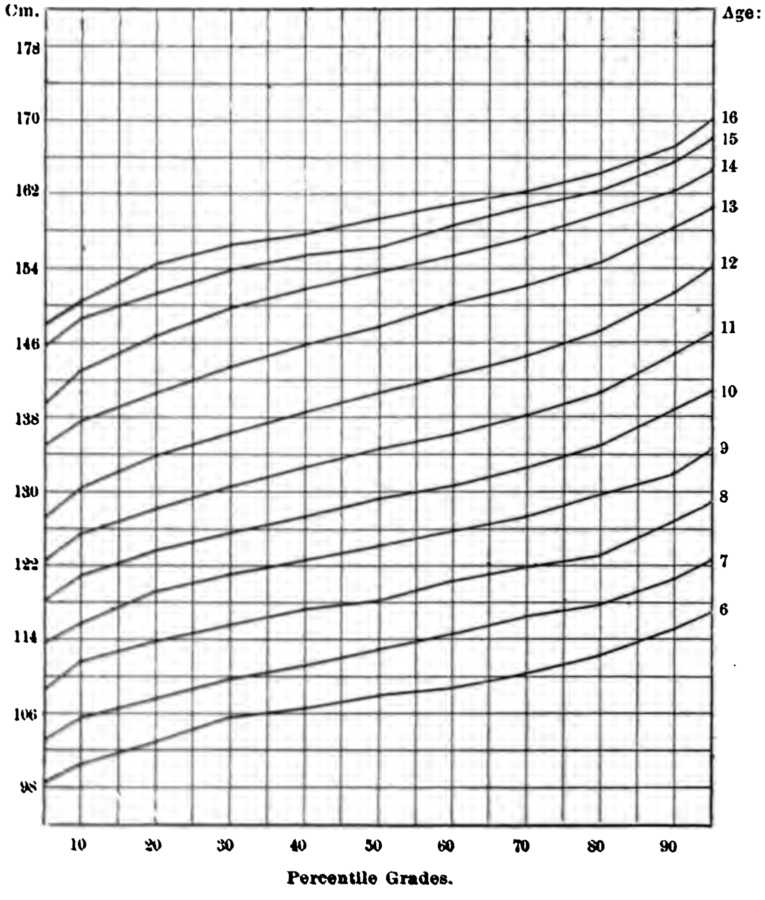
Vol. VI. No. 12. Plate X (from Table No. 19; pages 311, 314).

Girls' Height Sitting.



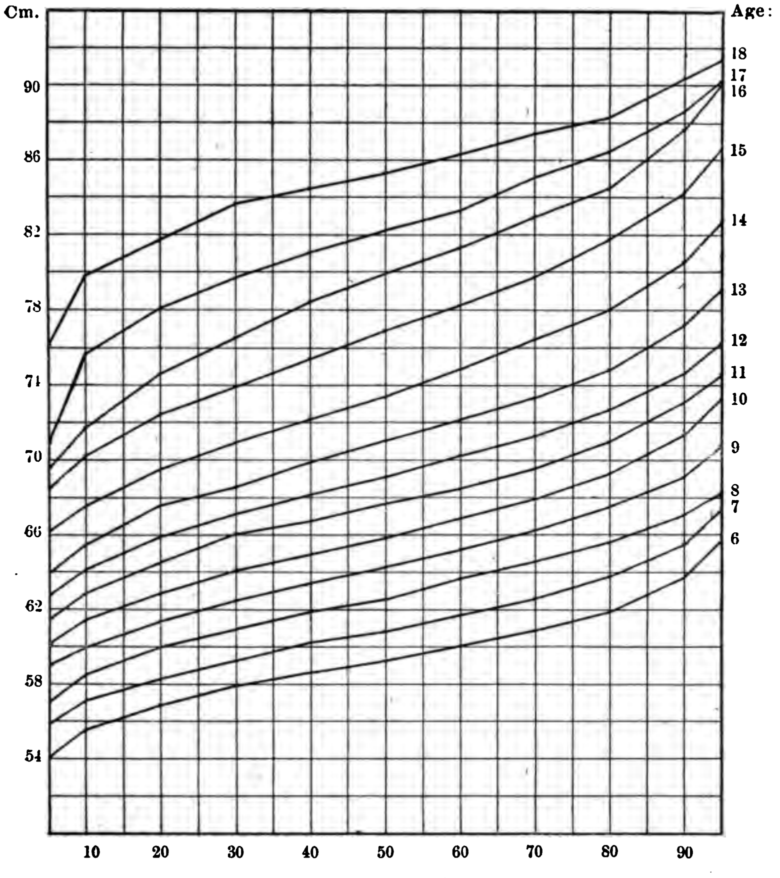
VOL. VI. NO. 12. PLATE XI (from Table No. 20; pages 311, 315).

Boys' Span of Arms.



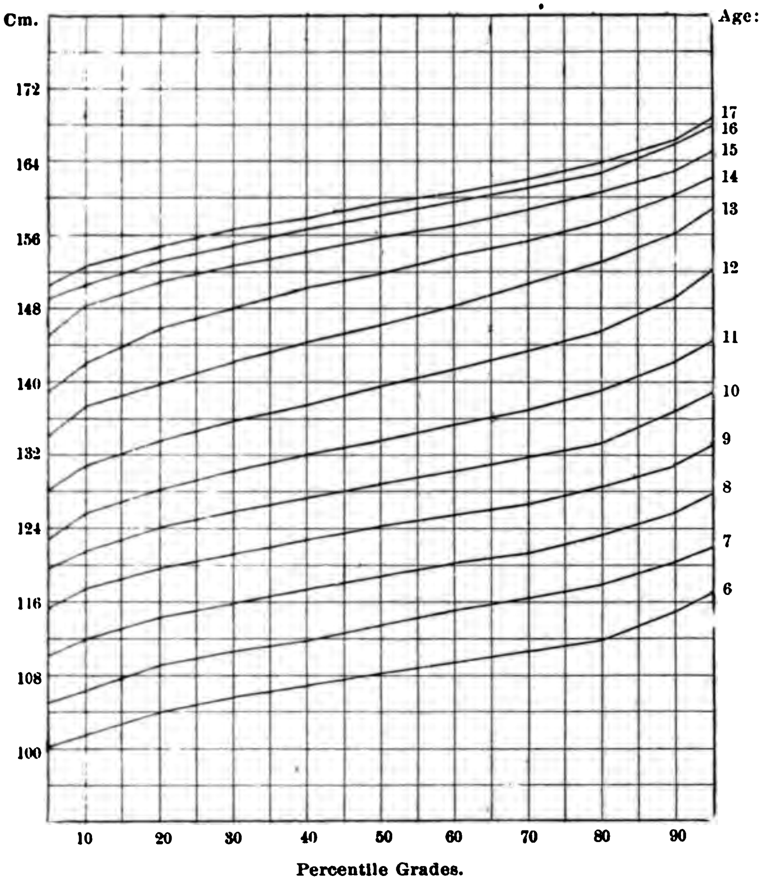
VOL. VI. NO. 12. PLATE XII (from Table No. 20; pages 311, 315).

Girls' Span of Arms.

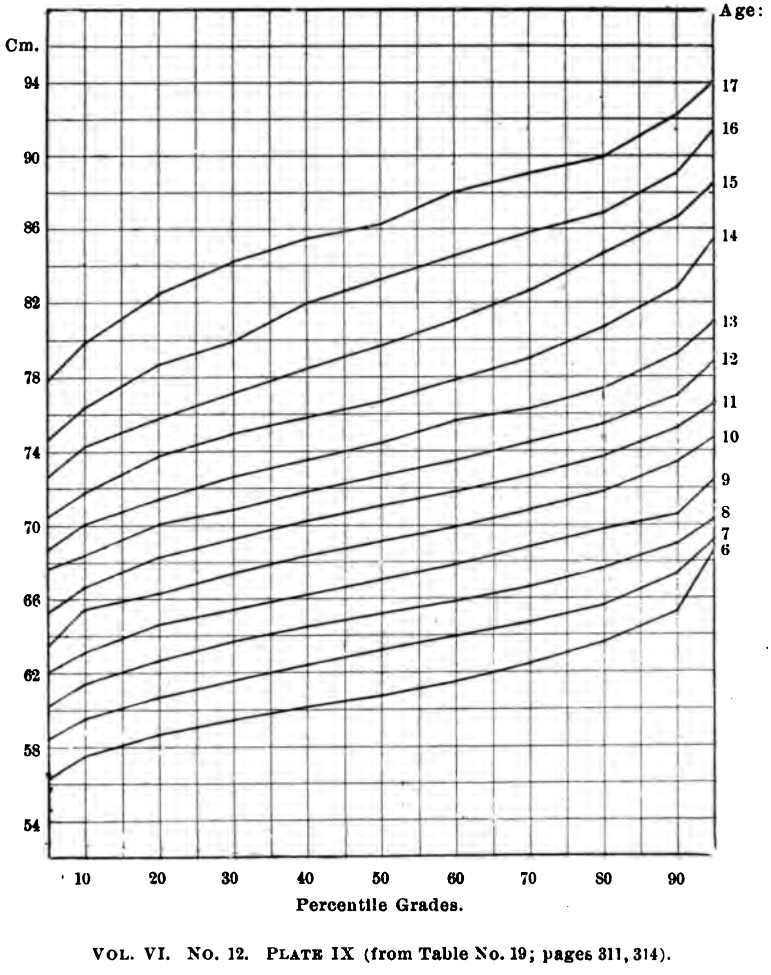


Vol. VI. No. 12. Plate XIII (from Table No. 23; pages 311, 818).

Boys' Girth of Chest.

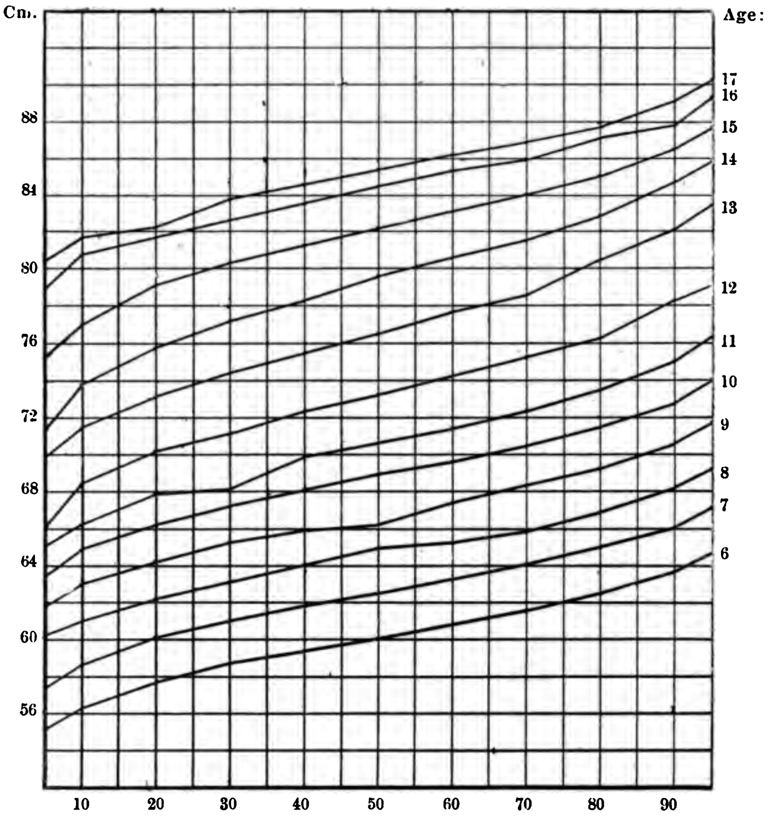


VOL. VI. NO. 12. PLATE VIII (from Table No. 18; pages 311, 313).
Girls' Height Standing.

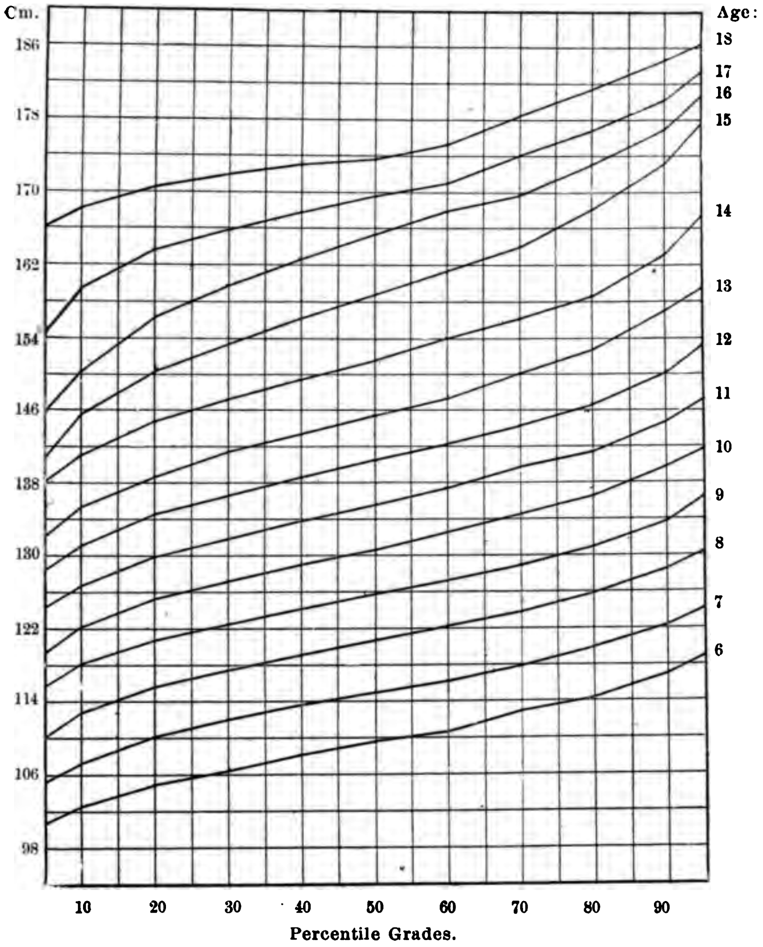


Vol. VI. No. 12. Plate IX (from Table No. 19; pages 311, 314).

Boys' Height Sitting.

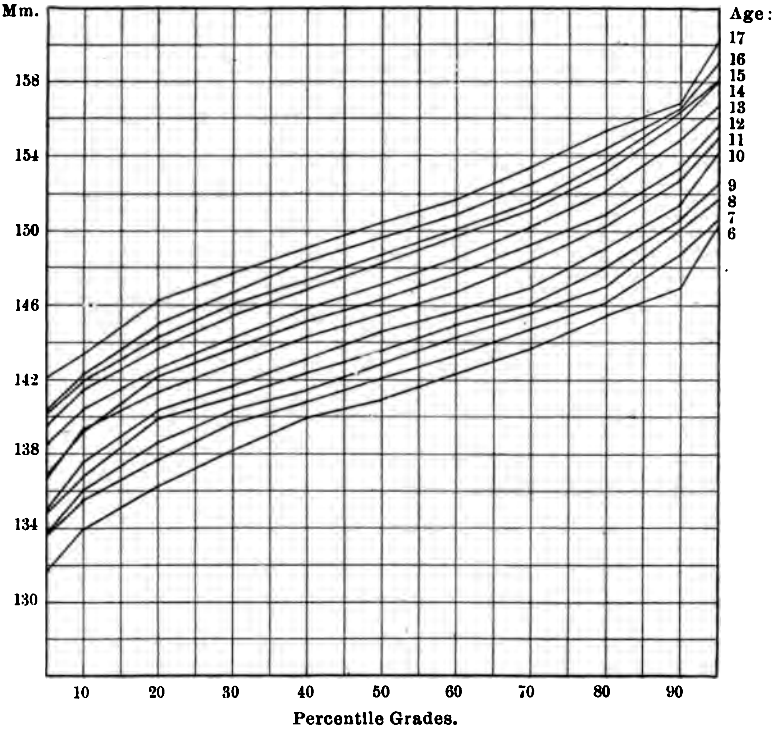


Vol. VI. No. 12. Plate X (from Table No. 19; pages 311, 314).
Girls' Height Sitting.



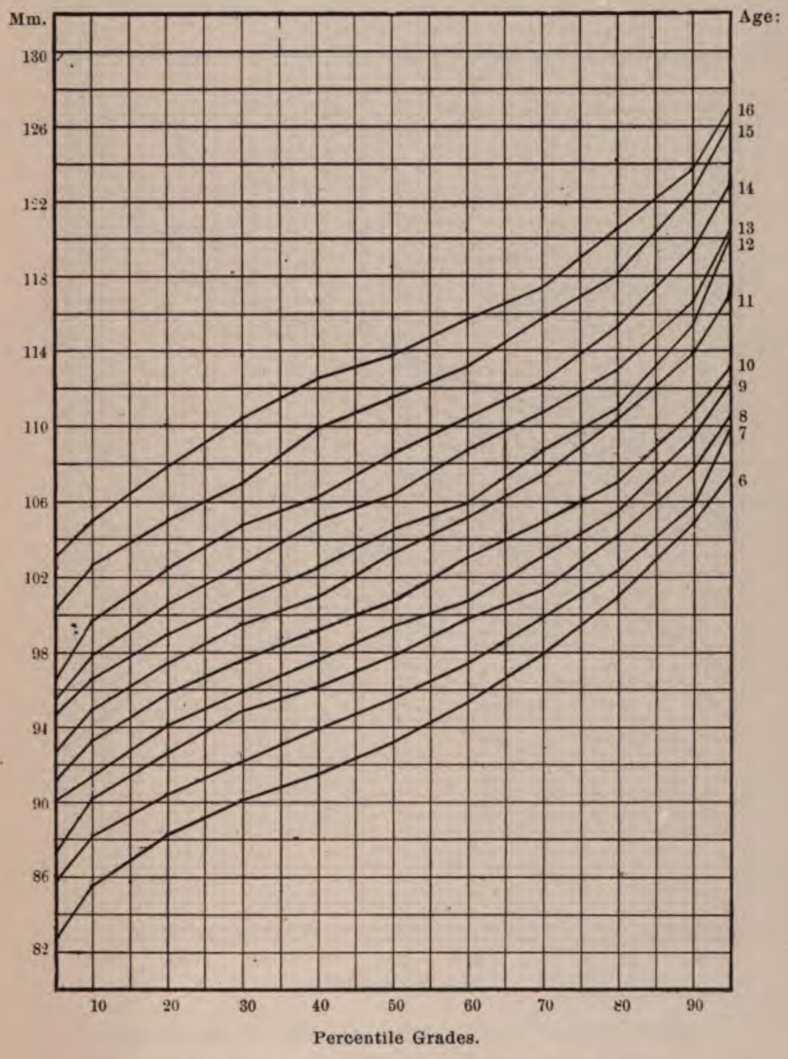
Vol. VI. No. 12. Plate XI (from Table No. 20; pages 311, 315).

Boys' Span of Arms.

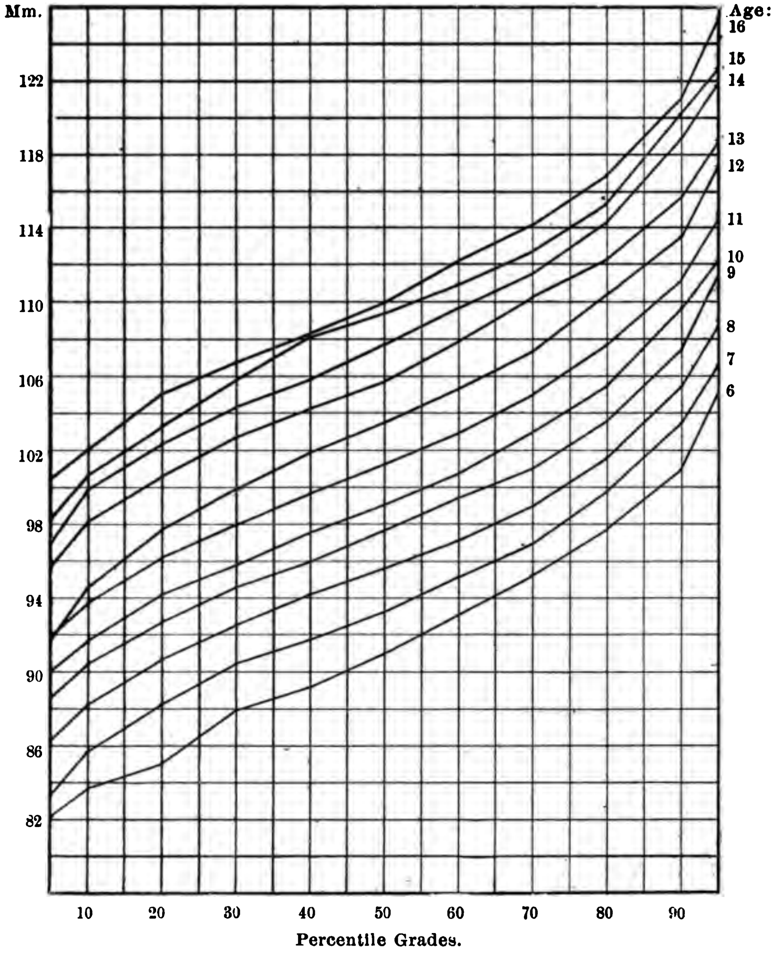


Vol. VI. No. 12. Plate XVIII (from Table No. 25; pages 311, 320).

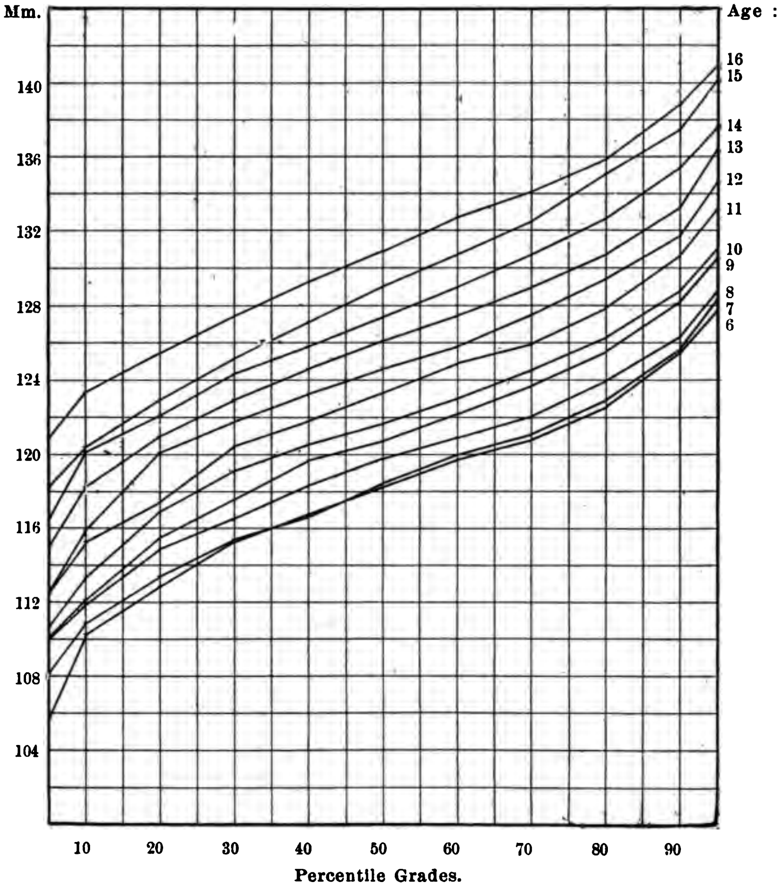
Girls' Width of Head.



VOL. VI. NO. 12. PLATE XIX (from Table No. 26; pages 311, 321).
Boys' Height of Face from Root of Nose to Point of Chin.

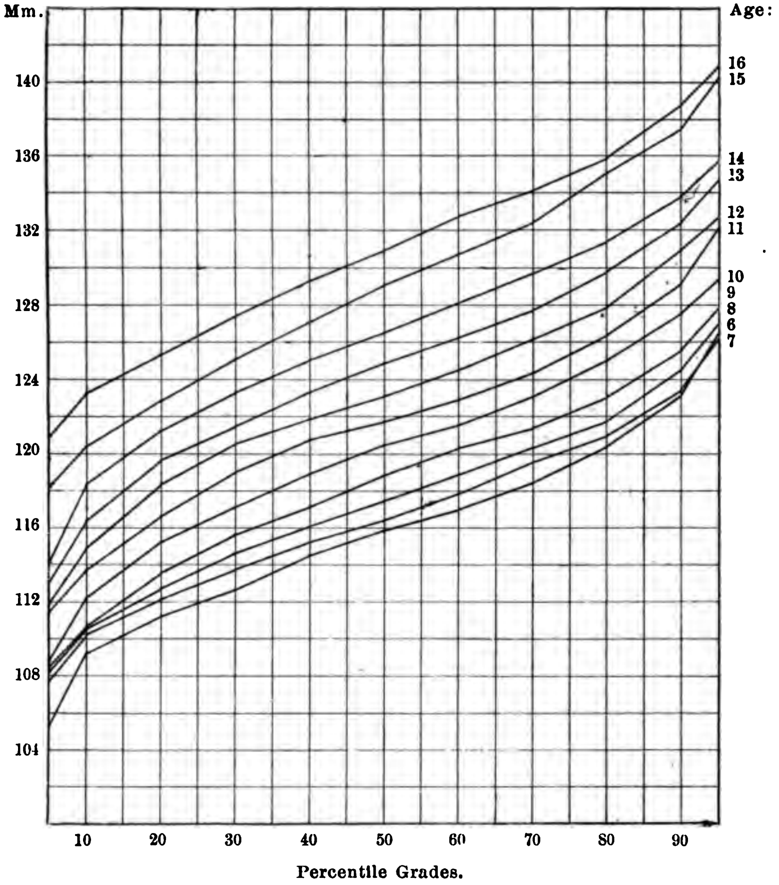


Vol. VI. No. 12. Plate XX (from Table No. 26; pages 311, 321).
Girls' Height of Face from Root of Nose to Point of Chin.



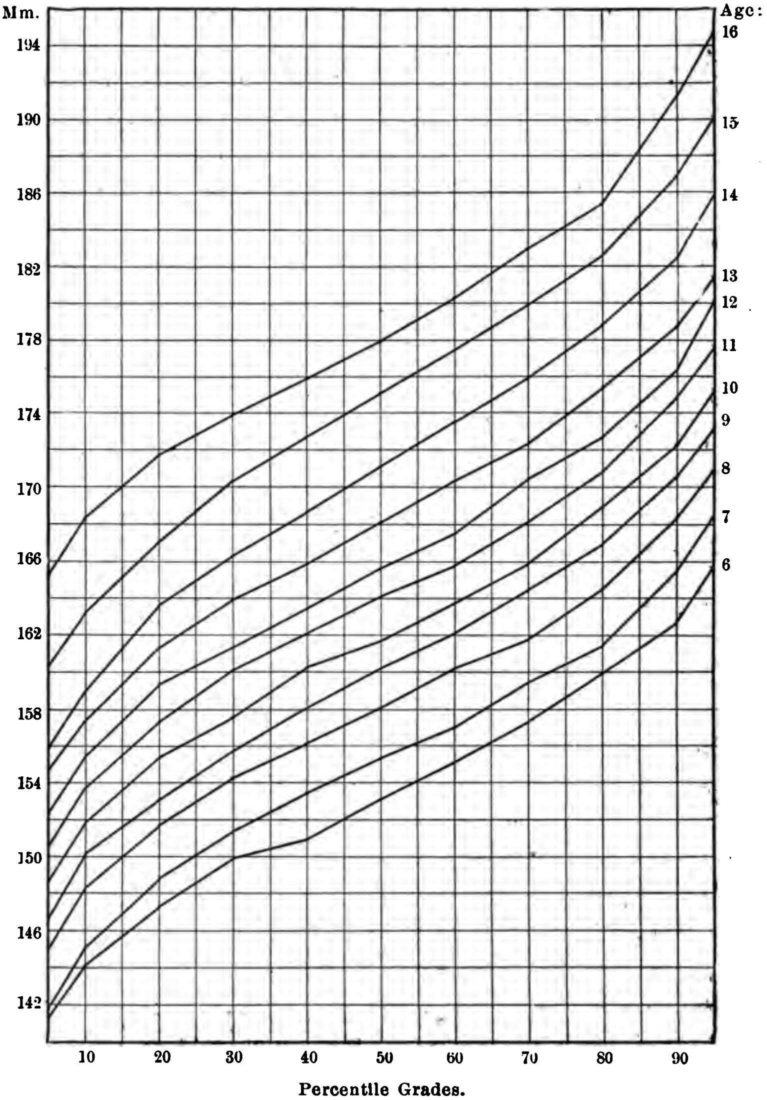
Vol. VI. No. 12. Plate XXI (from Table No. 27; pages 311, 322).

Boys' Width of Face.

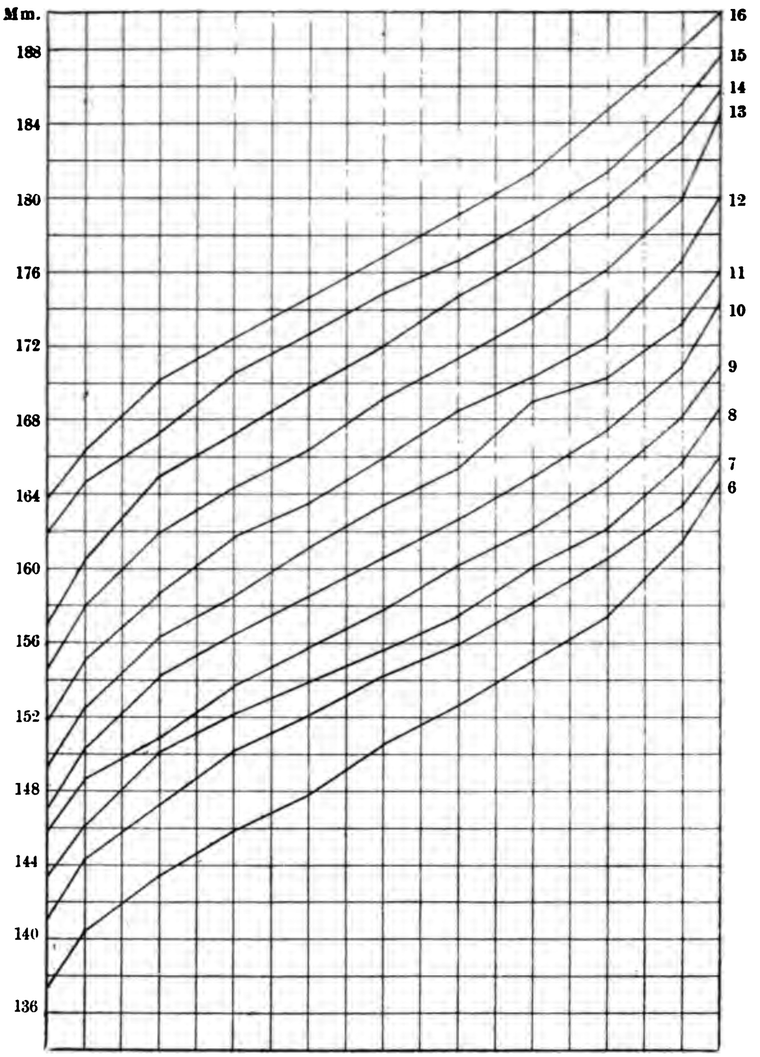


VOL. VI. NO. 12. PLATE XXII (from Table No. 27; page 322).

Girls' Width of Face.

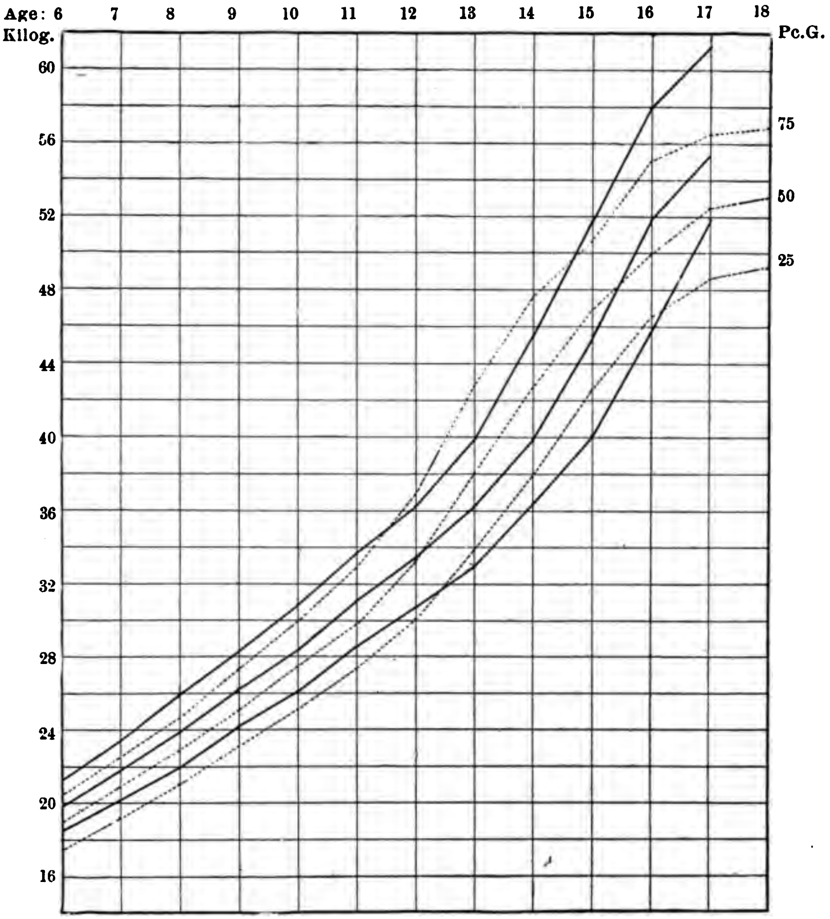


VOL. VI. NO. 12. Plate XXIII (from Table No. 28; pages 311, 323).
Boys' Height of Face from Hair-Line to Point of Chin.



VOL. VI. NO. 12. PLATE XXIV (from Table No. 28; pages 311, 323).

Girls' Height of Face From Hair-Line to Point of Chin.



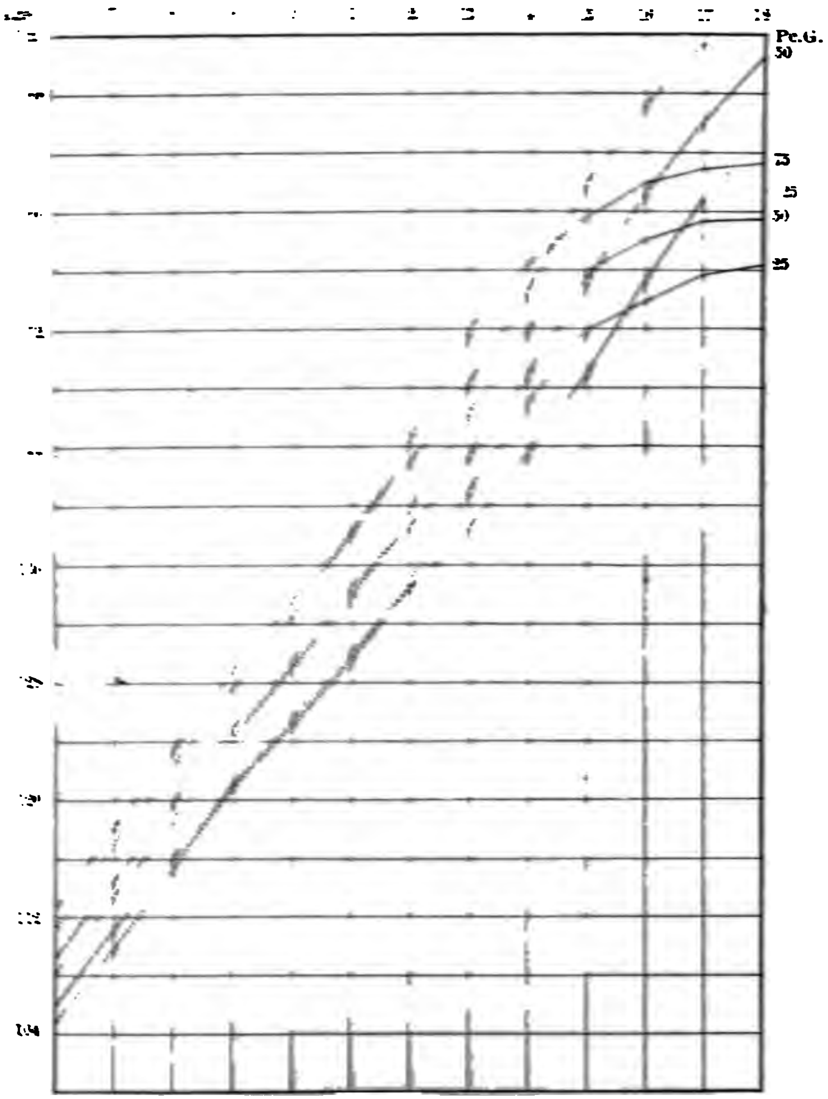
VOL. VI. NO. 12. PLATE XXV (from Table No. 39; pages 324, 351).

Weight.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. **Girls: Broken Lines.**

[illegible]



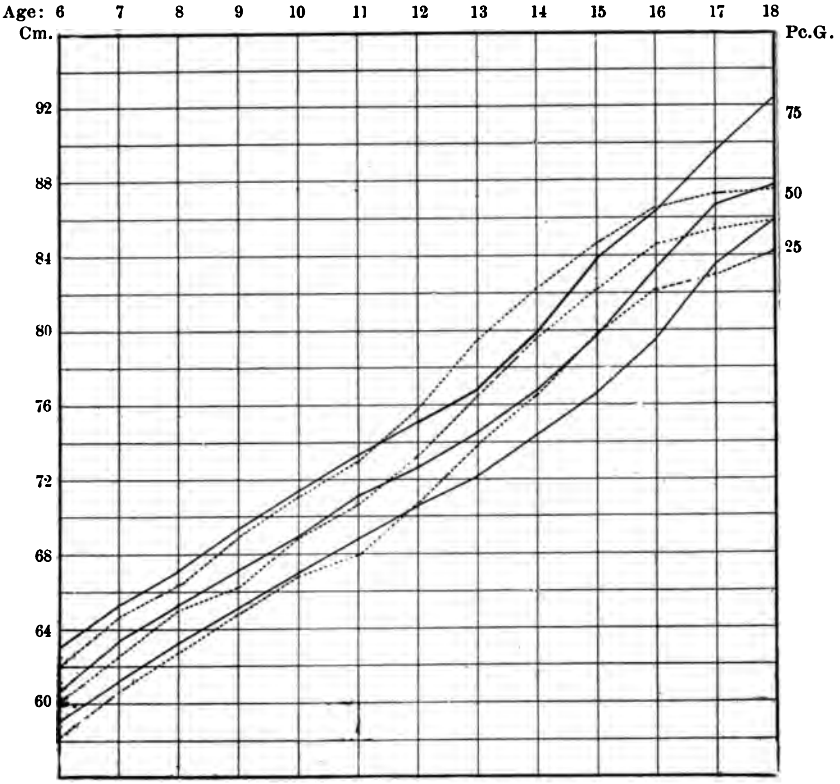
Vol. VI. No 12. P

No. 36; pages 324, 330.

ndes.

Boys: Unbrok

Girls: Broken Lines.

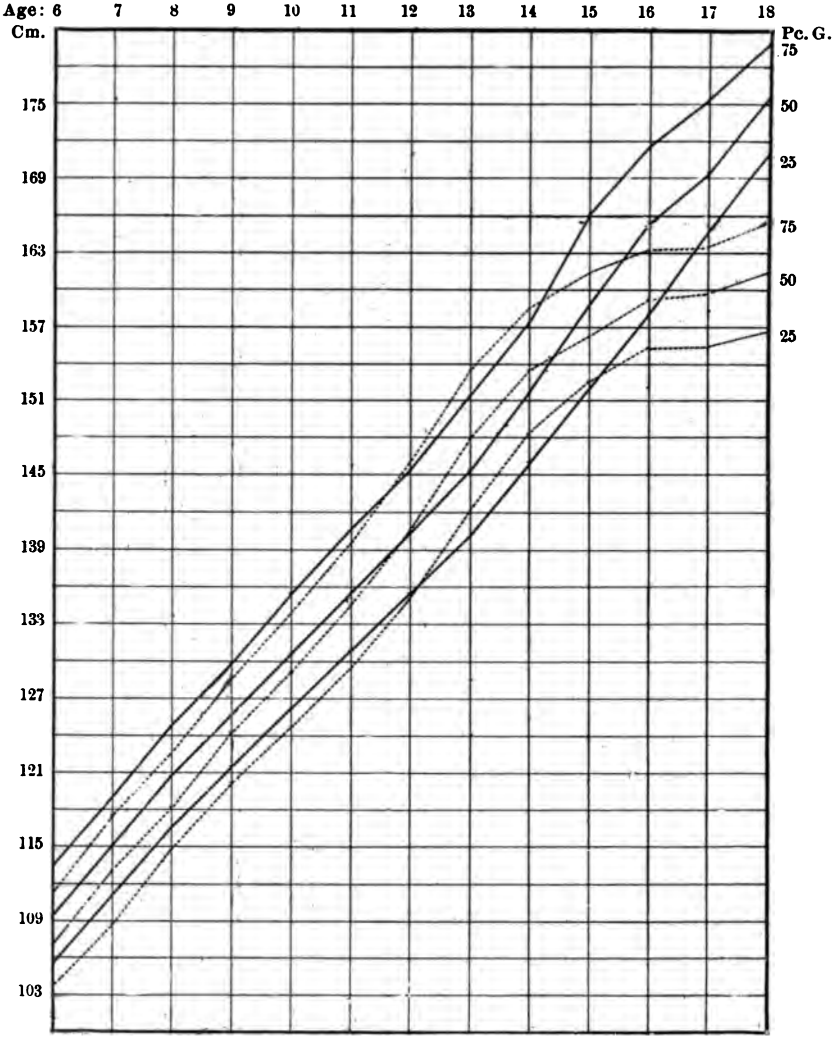


Vol. VI. No. 12. Plate XXVII (from Table No. 40; pages 324, 352).

Height Sitting.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. **Girls: Broken Lines.**

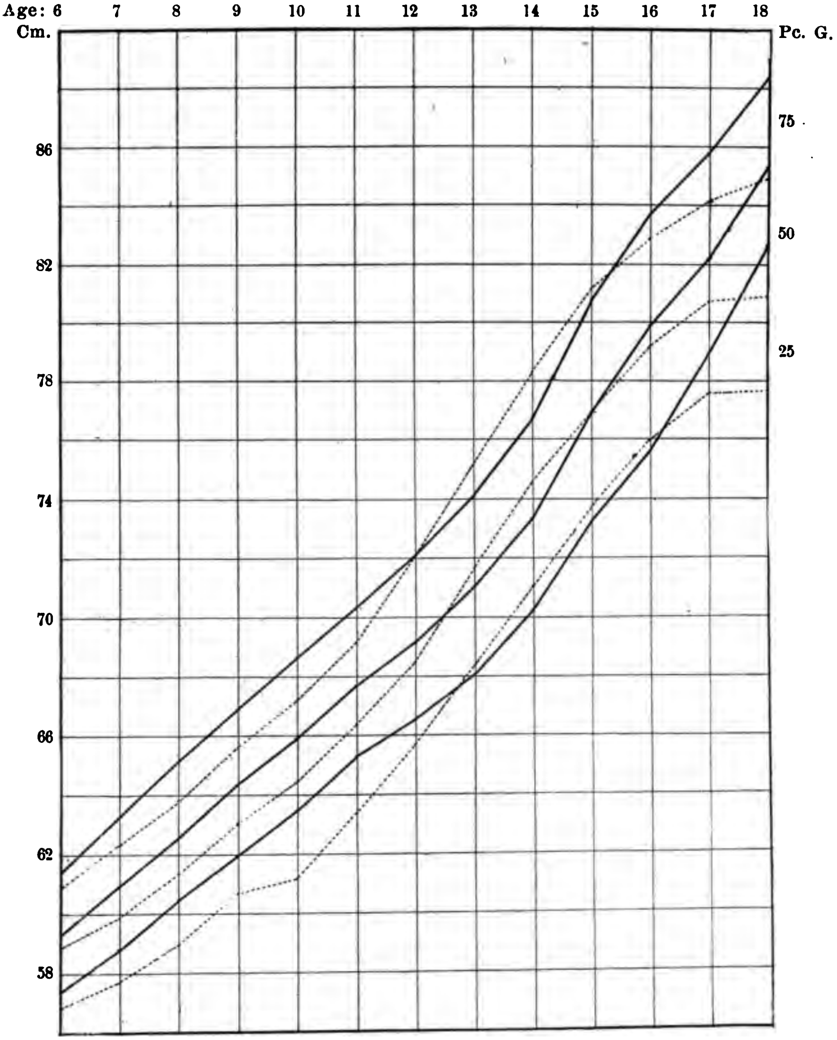


VOL. VI. NO. 12. PLATE XXVIII (from Table No. 41; pages 324, 353).

Span of Arms.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. Girls: Broken Lines.

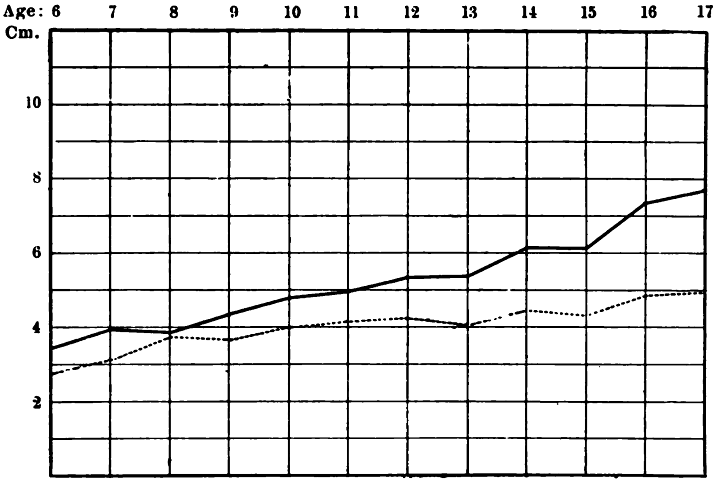


VOL. VI. NO. 12. PLATE XXIX (from Table No. 42; pages 324, 354).

Girth of Chest.

75, 50 and 25 Percentile Grades.

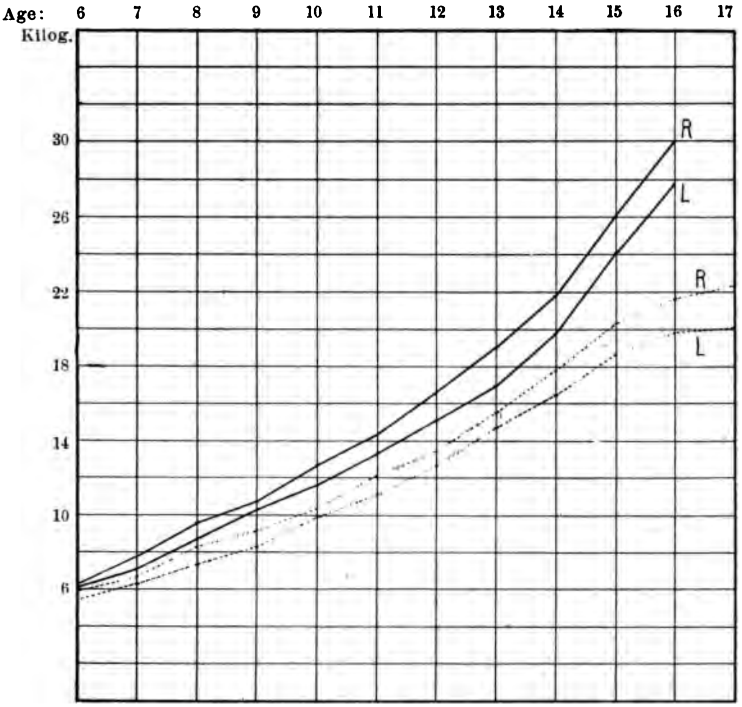
Boys: Unbroken Lines. **Girls: Broken Lines.**



VOL. VI. NO. 12. PLATE XXX (from Tables No. 21, 22; pages 316, 317, 325).

Mean Expansion of Chest.

Boys: Unbroken Lines. Girls: Broken Lines.

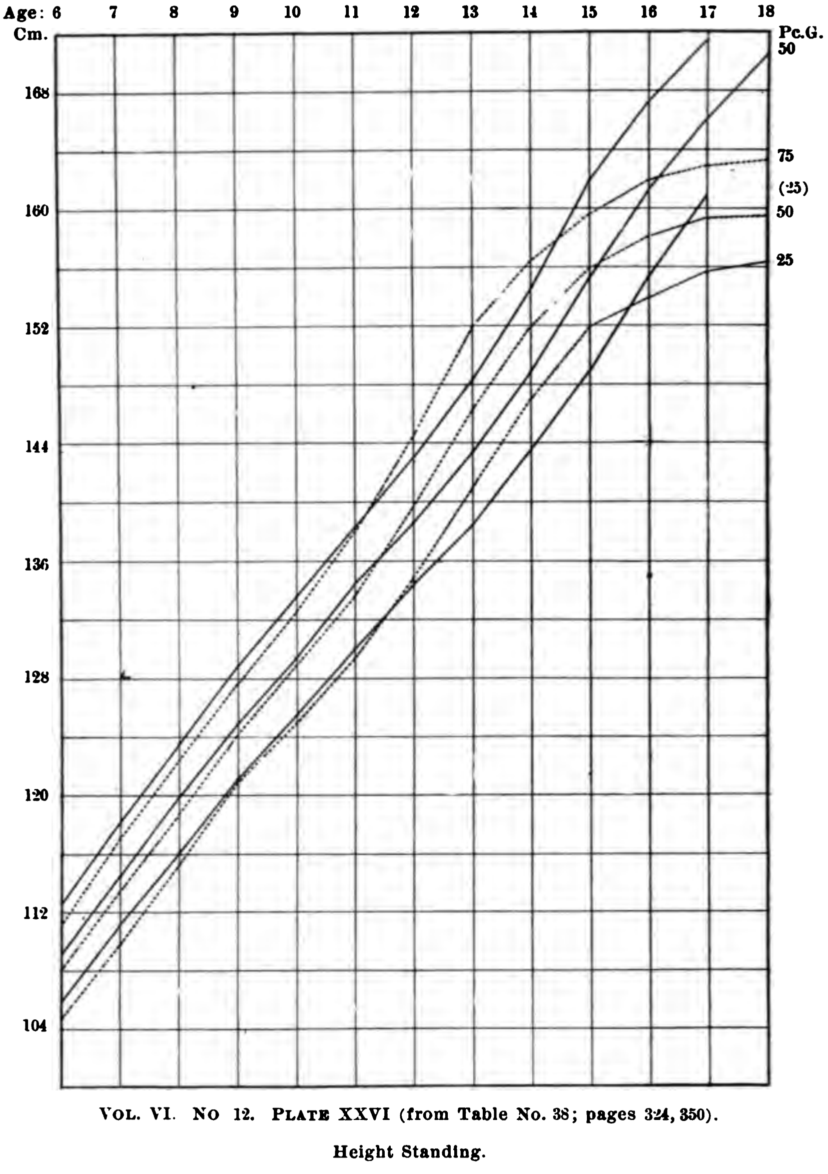


Vol. VI. No. 12. Plate XXXI (from Tables No. 43, 44; pages 325, 355, 356).

Mean Strength of Squeeze.

R: Right Hand. **L: Left Hand.**

Boys: Unbroken Lines. **Girls: Broken Lines.**

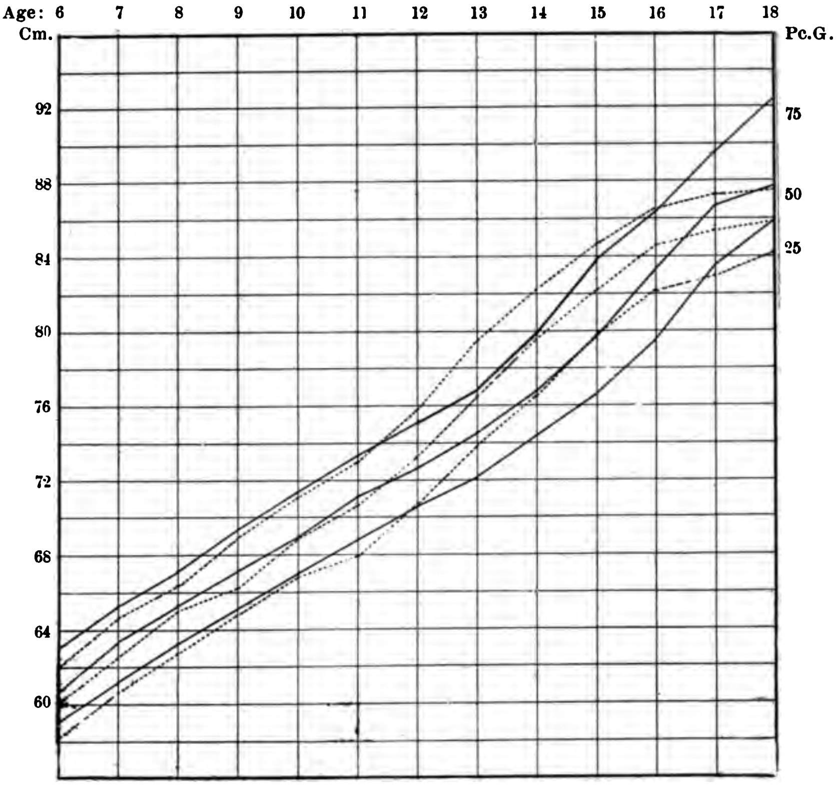


VOL. VI. NO 12. PLATE XXVI (from Table No. 38; pages 324, 350).

Height Standing.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. Girls: Broken Lines.

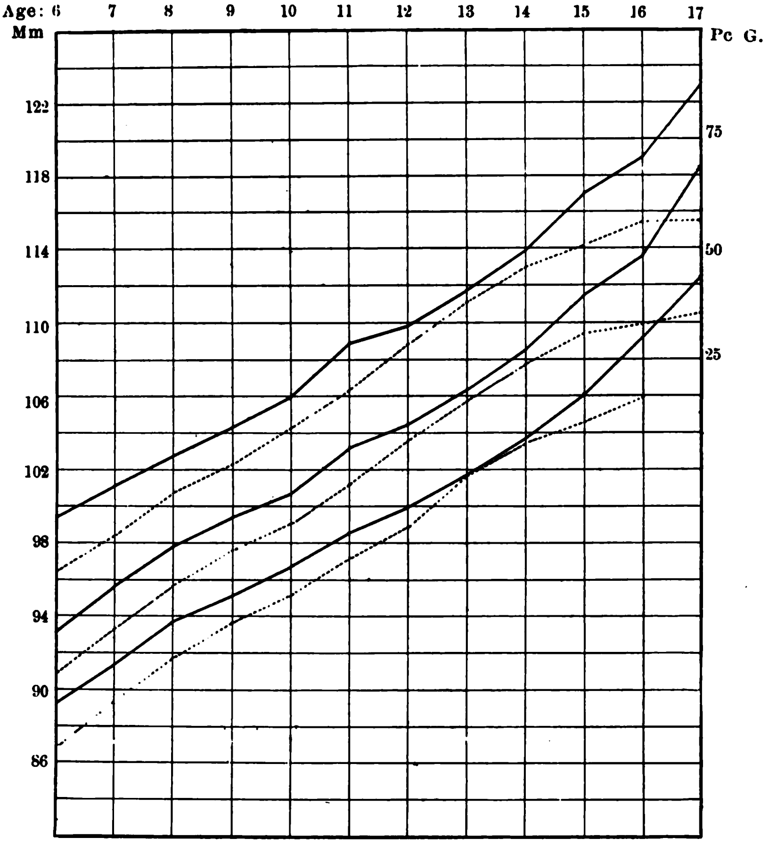


VOL. VI. NO. 12. PLATE XXVII (from Table No. 40; pages 324, 352).

Height Sitting.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. Girls: Broken Lines.

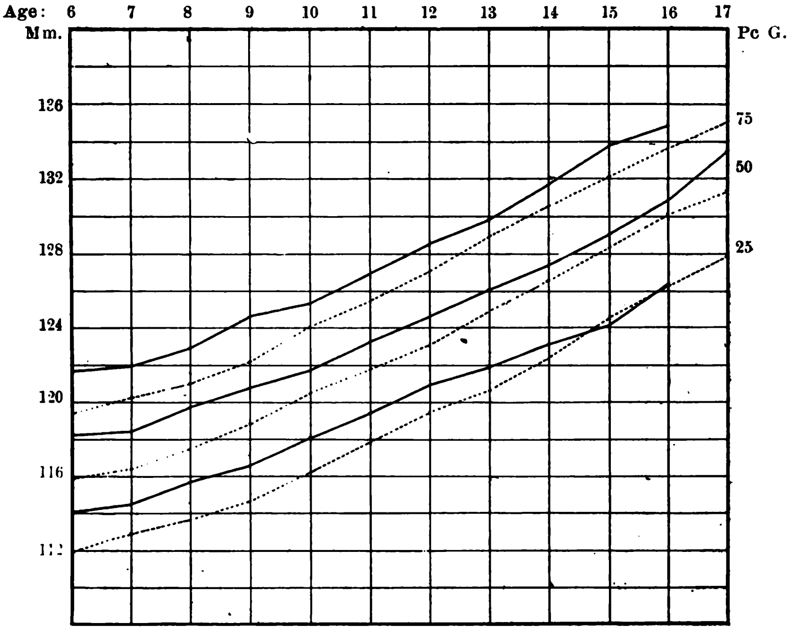


VOL. VI. NO. 12. PLATE XXXIV (from Table No. 49; pages 325, 361).

Height of Face from Root of Nose to Point of Chin.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. Girls: Broken Lines.

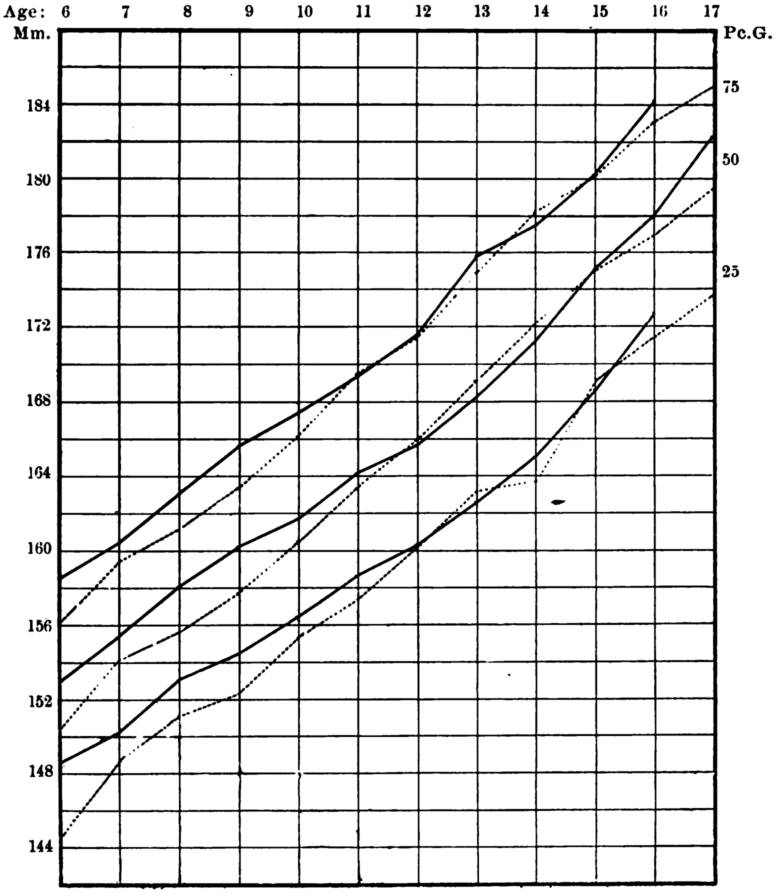


VOL. VI. NO. 12. PLATE XXXV (from Table No. 50; pages 325, 362).

Width of Face.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. Girls: Broken Lines.

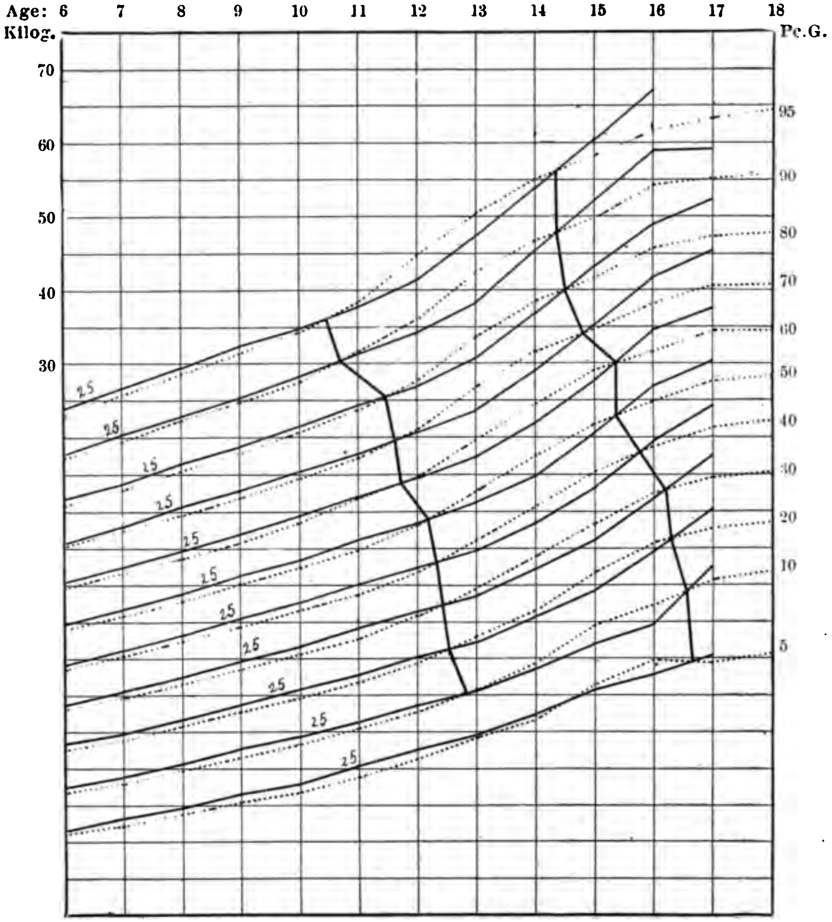


VOL. VI. NO. 12. PLATE XXXVI (from Table No. 51; pages 325, 363).

Height of Face from Hair-Line to Point of Chin.

75, 50 and 25 Percentile Grades.

Boys: Unbroken Lines. **Girls: Broken Lines.**

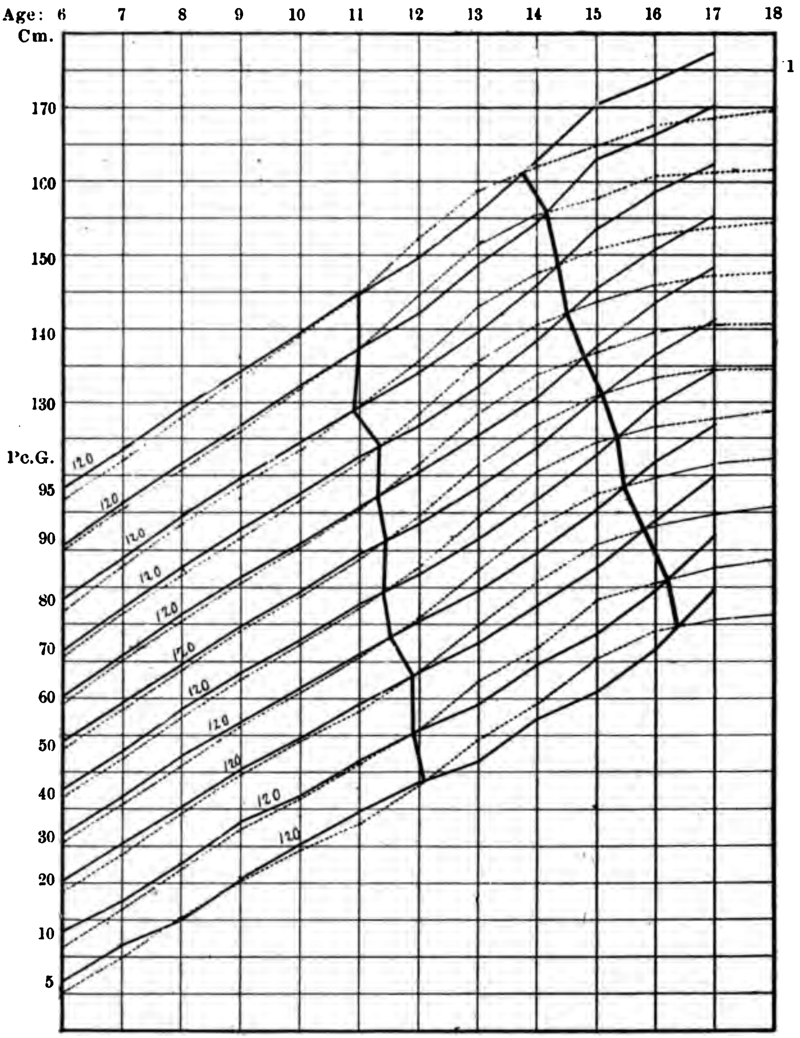


VOL. VI. NO. 12. PLATE XXXVII (from Table No. 17; pages 312, 325).

Percentile Grades.

Weight.

Boys: Unbroken Lines. Girls: Broken Lines.

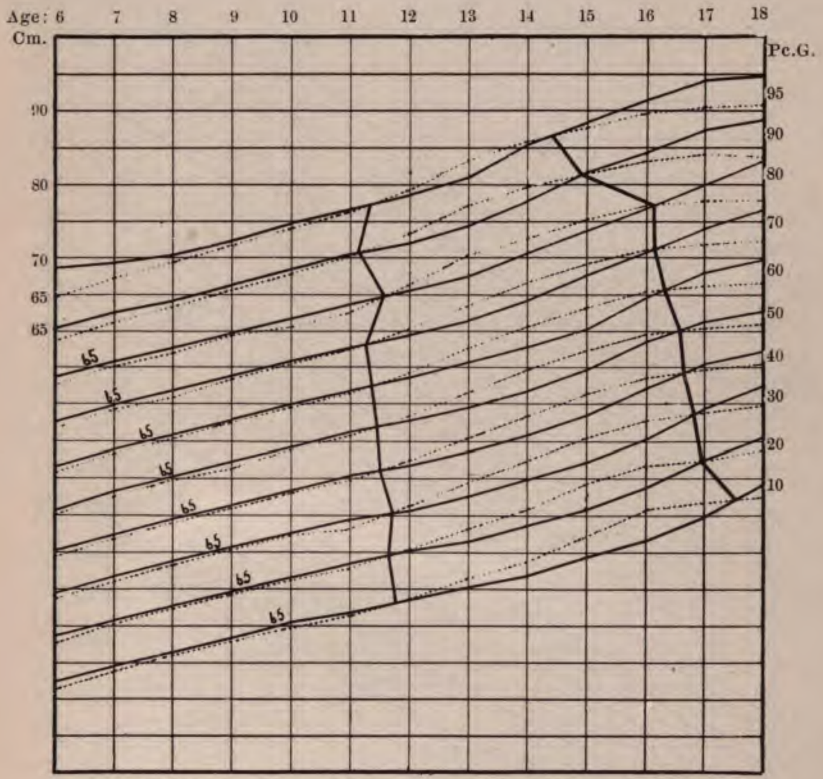


VOL. VI. NO. 12. PLATE XXXVIII (from Table No. 18; pages 313, 325).

Percentile Grades.

Height Standing.

Boys: Unbroken Lines. Girls: Broken Lines.

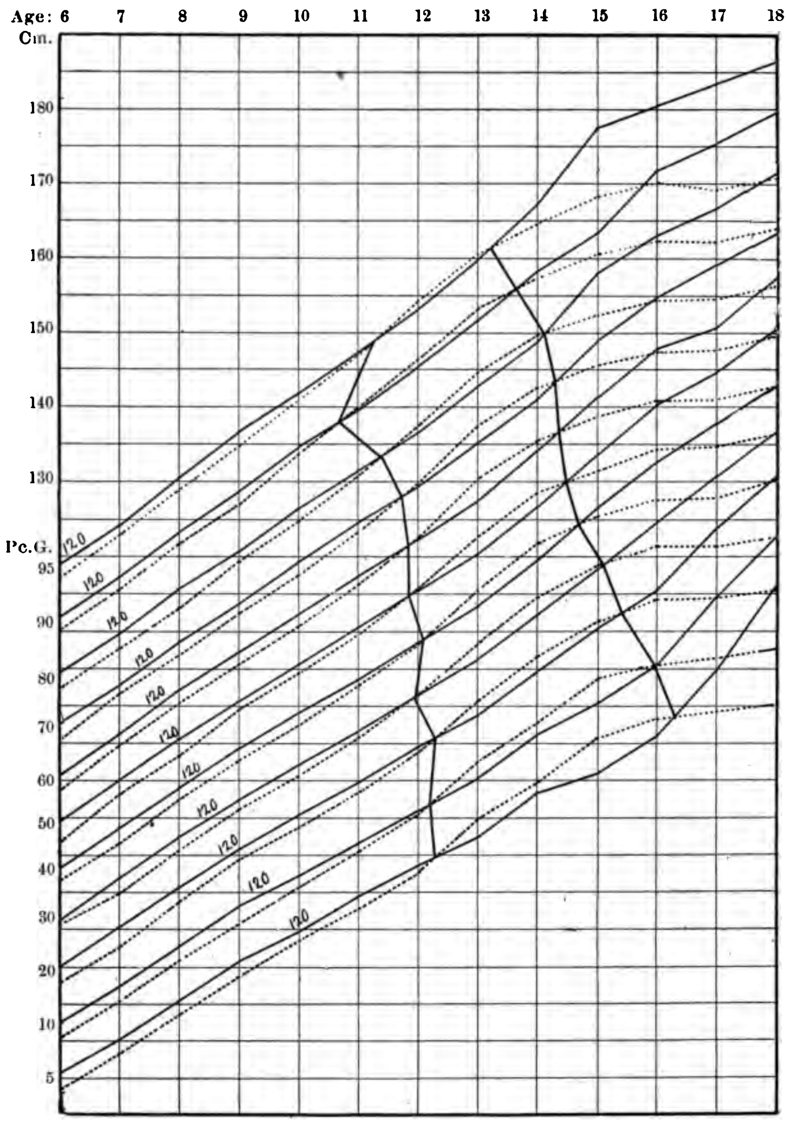


VOL. VI. NO. 12. PLATE XXXIX (from Table No. 19; pages 314, 325).

Percentile Grades.

Height Sitting.

Boys: Unbroken Lines. **Girls: Broken Lines.**

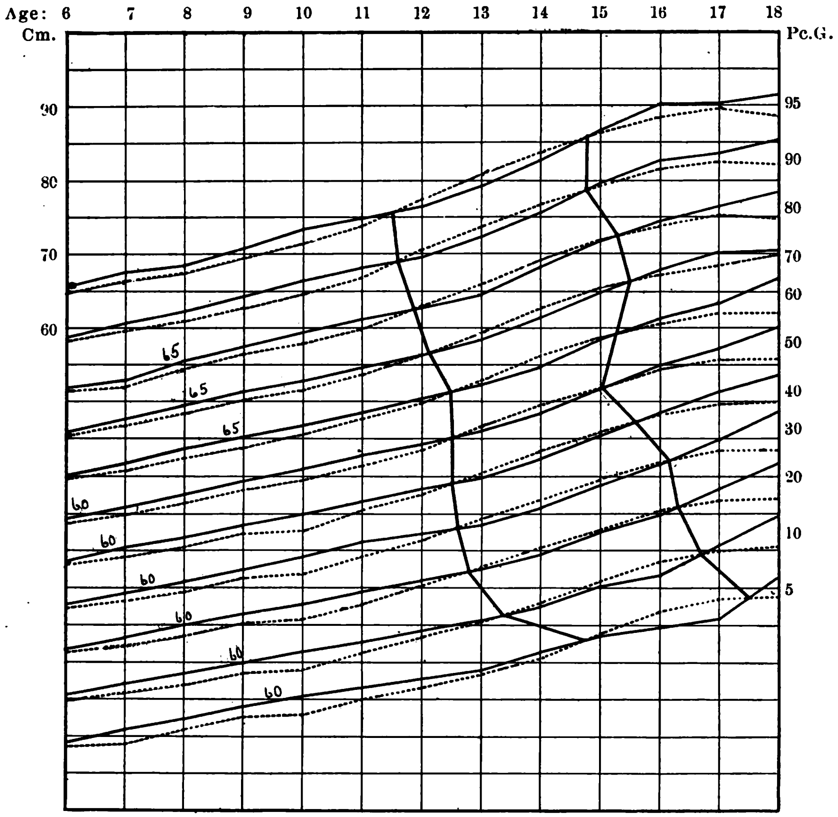


VOL. VI. NO. 12. PLATE XL (from Table No. 20; pages 315, 325).

Percentile Grades.

Span of Arms.

Boys: Unbroken Lines. Girls: Broken Lines.

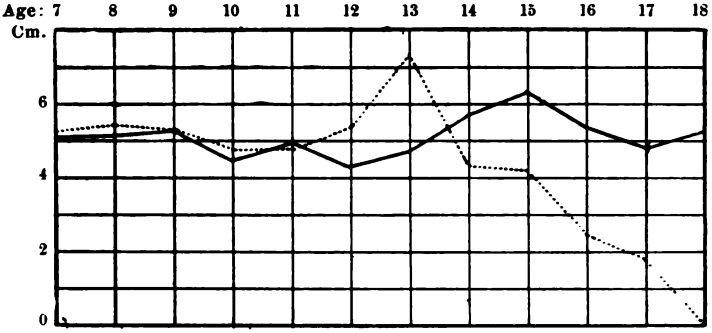


VOL. VI. NO. 12. PLATE XLI (from Table No. 23; pages 318, 325).

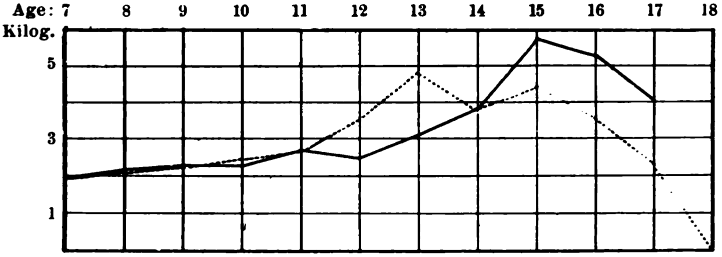
Percentile Grades.

Girth of Chest.

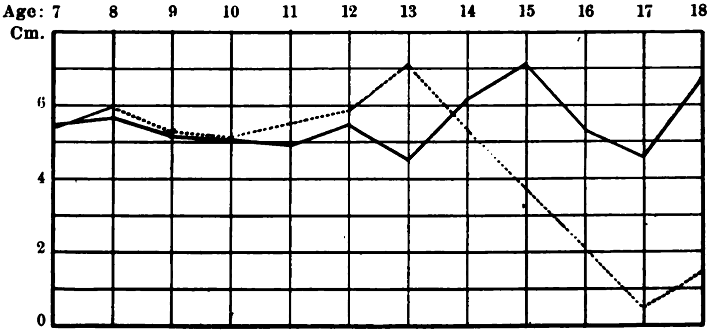
Boys: Unbroken Lines. Girls: Broken Lines.



Height Standing.



Weight.

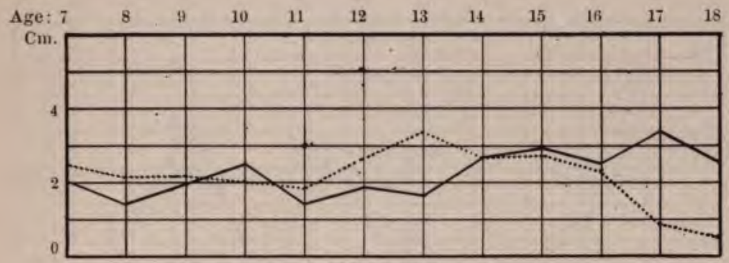


Span of Arms.

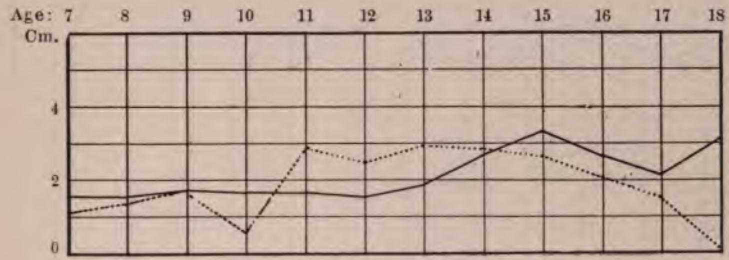
VOL. VI. NO. 12. PLATE XLII (from Tables No. 30, 31, 32; pages 327, 328, 329, 330.

Absolute Annual Increase.

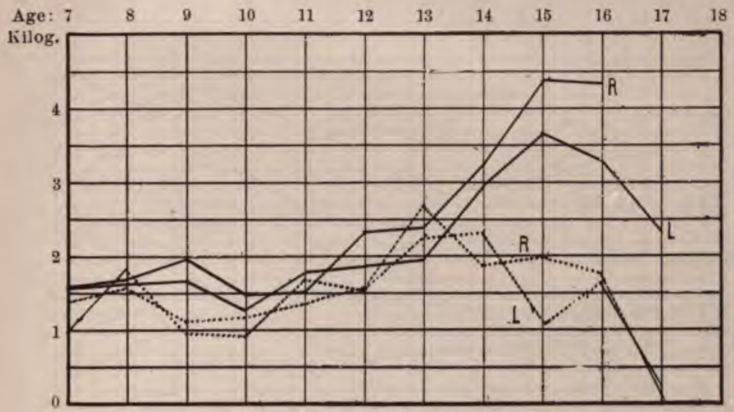
Boys: Unbroken Lines. Girls: Broken Lines.



Height Sitting.



Girth of Chest.

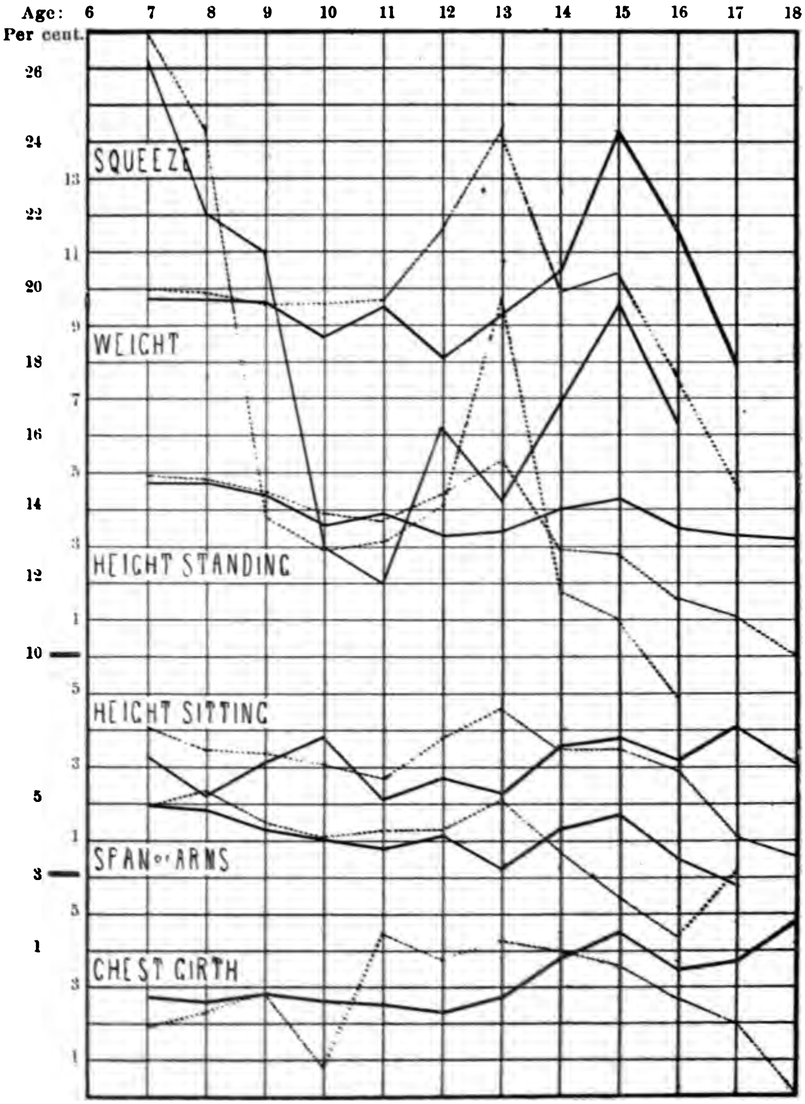


Strength of Squeeze.

VOL. VI. NO. 12. PLATE XLIII (from Tables No. 33, 34, 43, 44, 45; pages 327, 331, 332, 355, 366)

Absolute Annual Increase.

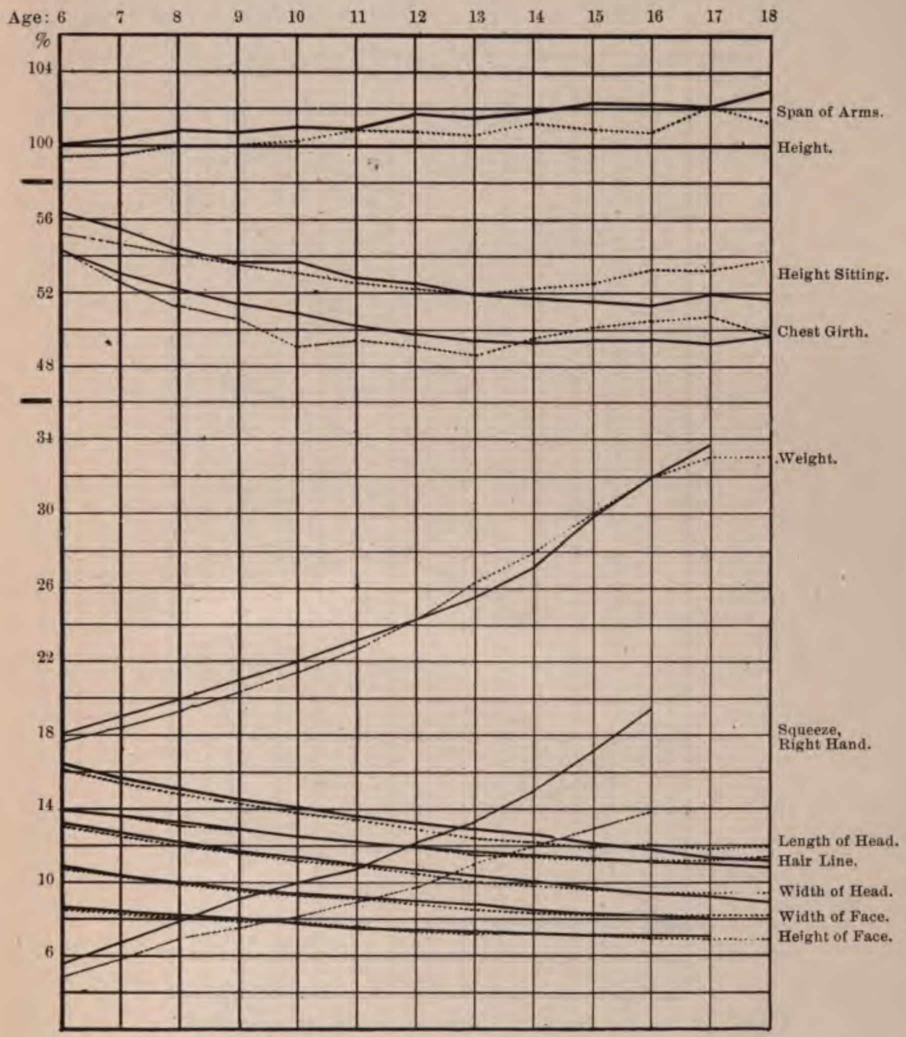
Boys: Unbroken Lines. Girls: Broken Lines.



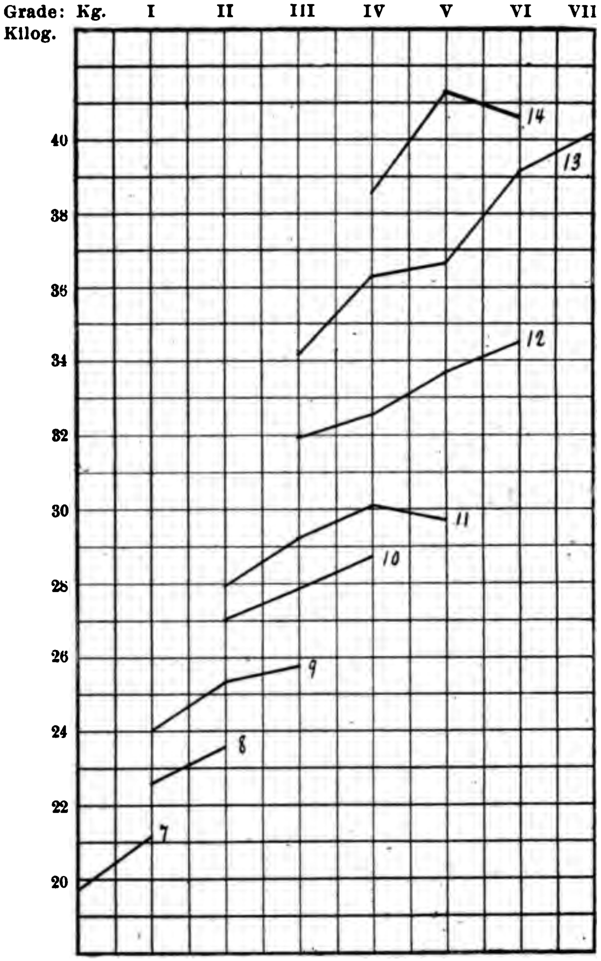
VOL. VI. NO. 12. PLATE XLIV (from Tables No. 38 to 43; pages 327, 333, 350 to 355).

Relative Annual Increase.

Boys: Unbroken Lines. Girls: Broken Lines.



VOL. VI. NO. 12. PLATE XLV (from Table No. 38 to No. 51; pages 334, 350 to 363).
Relation of Average Weight, Span of Arms, Girth of Chest, etc., to Average Height.



Vol. VI. No. 12. Plate XLVI (from Table No. 36; pages 336, 337).

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